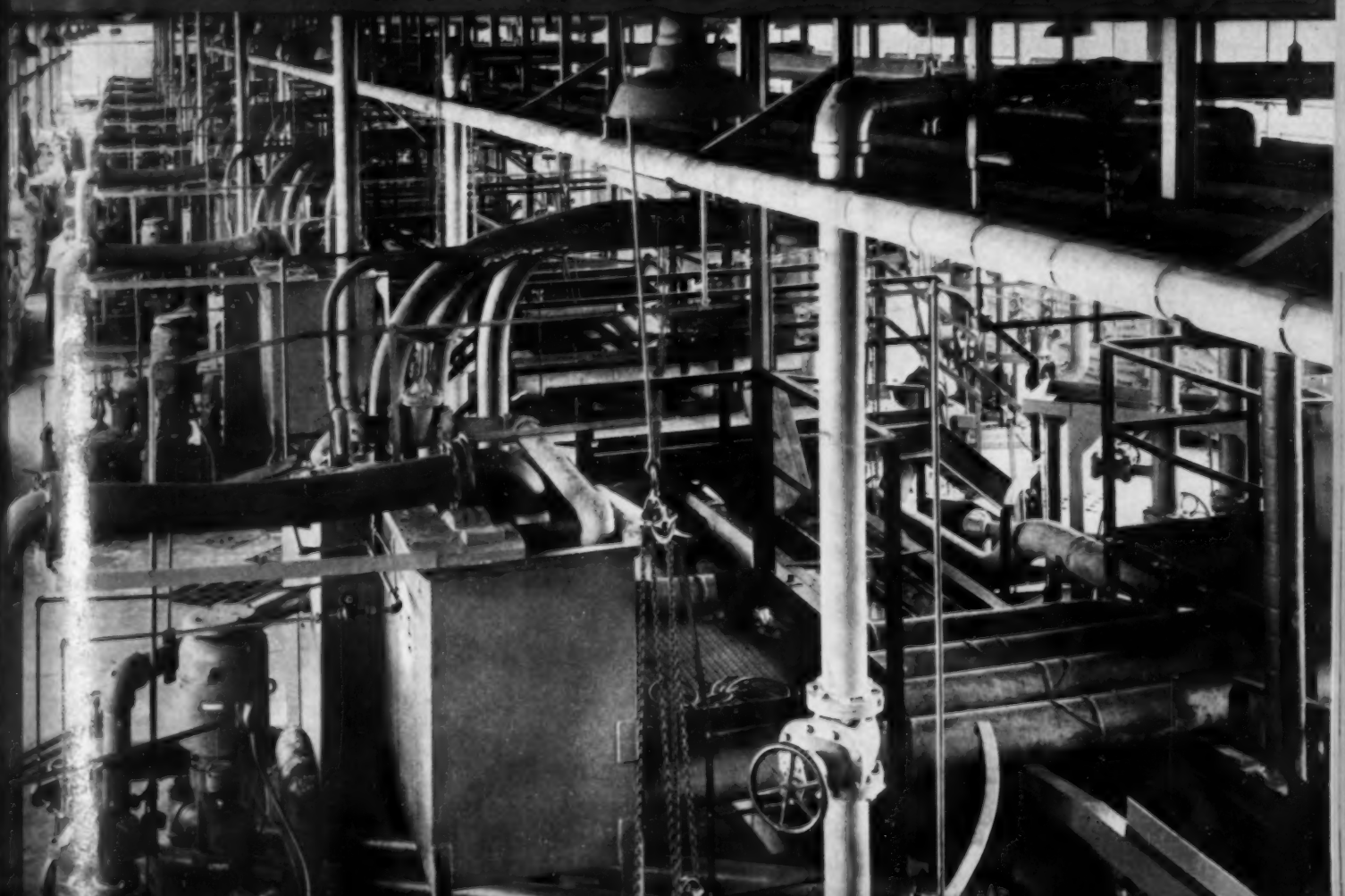
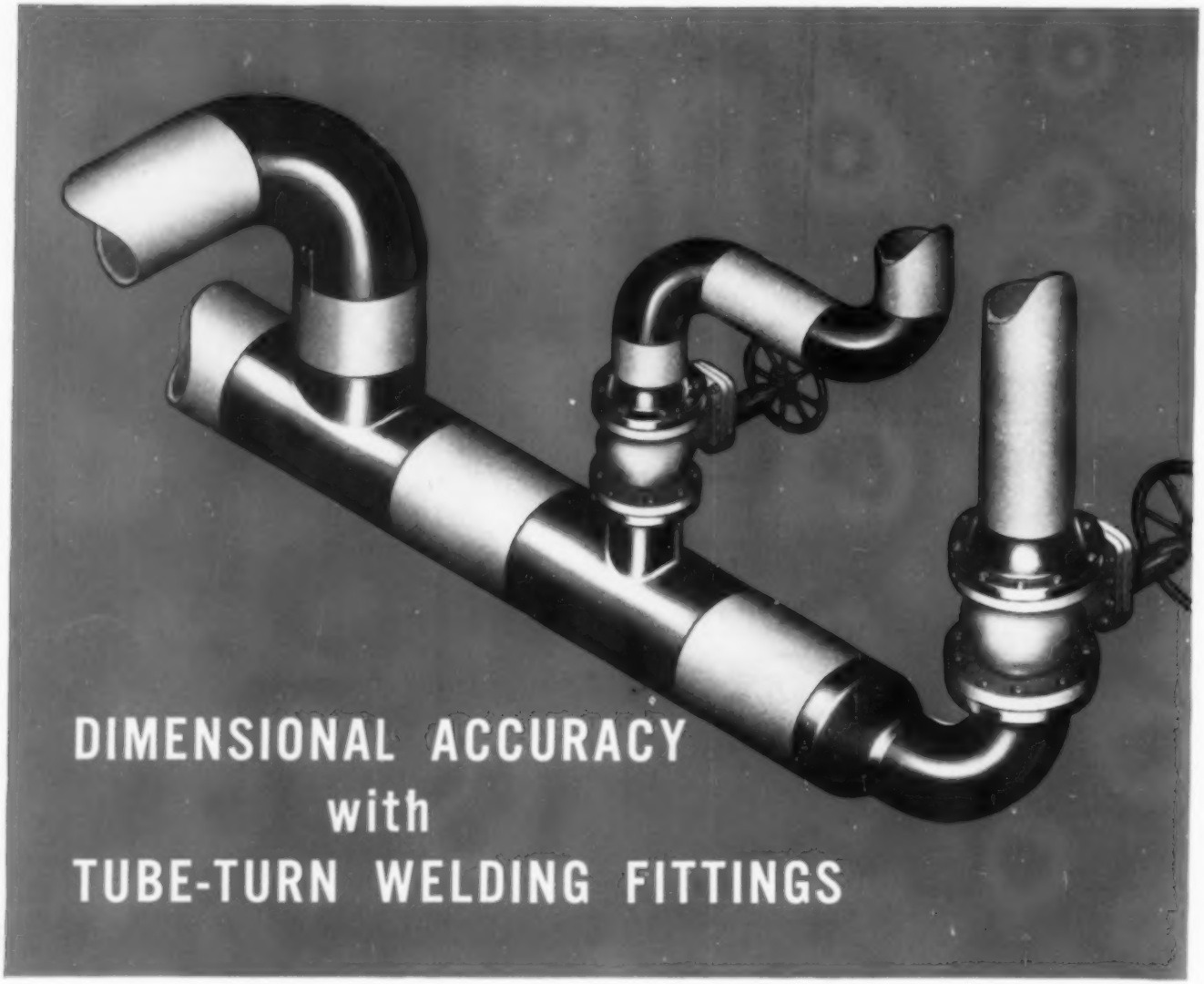
CHEMICAL & Metallurgical ENGINEERING

Operating floor and pipe gallery above processing units in Socony Vacuum's bead catalyst plant





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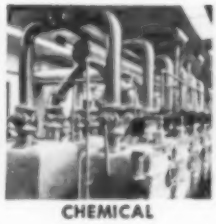
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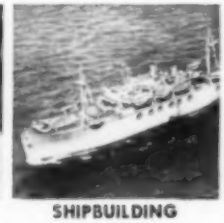
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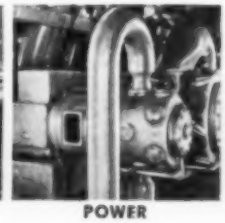
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CHEMICAL
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ENGINEERING

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What Price Exports?

IN a topsy-turvy world in which peace is still a fleeting goal, it seems almost futile to think about foreign trade. Yet there will come a time, sooner perhaps than we realize, when domestic needs will have been satisfied and our industries will be looking hungrily for markets abroad. Whether or not they find them may well depend upon decisions that must be made within the next few weeks and months.

In the first place, what do we want most to export? Should it be capital, capital goods, consumer products, or that very intangible export we have come to call "technical know-how?" Each has its advantages and disadvantages. As far as money is concerned, our government is already committed to several billions in foreign loans over which we apparently will have little control. Presumably part of these funds will go to reviving and rehabilitating old-world industries that may or may not be able to compete with modern machinery in efficiently managed plants elsewhere in the world. If they can't compete our money is wasted; if they can, some people fear we may be undermining our own business prospects.

Would it be better to export finished products as consumer goods, and to depend for payment on imports of foreign raw materials or non-competitive manufactures? In countries that can pay us, either in money or goods, we would be smart to begin that trade at the very earliest opportunity, even if it means setting aside a certain percentage of production for which there is still urgent need in this country. One important chemical company has allocated a sixth of its output to foreign markets. Another is determined to meet its prewar quota for exports. Management in both feel that this is essential, because otherwise they will lose their markets to other exporting countries or build up competition by encouraging domestic production.

Or should we export engineering services and technical know-how, rather than money or goods? Since further industrialization of the world is inevitable, and probably desirable, should we not do what we can to promote the use abroad of the best of our processes and equipment? A heavy export of capital goods and equipment designed, constructed and perhaps operated at least temporarily by American technologists, would seem to be our most logical chemical engineering contribution to the financial recovery of the world. But would it be the best for us? We tried it in Russia, and to a lesser extent in Mexico and elsewhere in Latin-America before the World War, and our experiences were none too heartening.

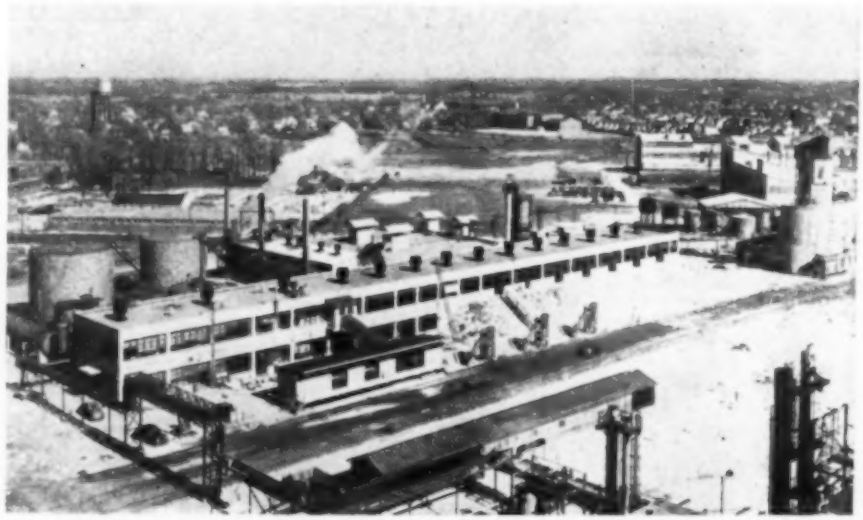
Col. Allan M. Pope, president of the First Boston Corporation, had a slightly different solution for this problem when he recently addressed the American Section of the Society of Chemical Industry. He would favor the establishment by an American chemical company of a foreign subsidiary which would build a branch plant abroad partly financed by local funds, but efficiently designed, operated and managed by American engineers and technologists. As its operation succeeded, most of the American investment would be retired, preferably through foreign exchange created by the enterprise itself. Eventually the American company would have its original principal repaid and receive a continuing return from a well-run foreign company employing local labor and substantially owned by local interests. Should such a plan prove attractive to American businessmen and technologists Colonel Pope assured us that the investment bankers will readily provide the necessary funds.

The foreign trade problems of chemical industry cannot be solved by any single formula or procedure. They will continue to depend on political, economic and social developments which cannot yet be forecasted with certainty. But we can be sure that foreign needs for goods and processes and equipment are going to be met, and probably with the help of American money, so it is good business on our part as taxpayers as well as technologists to insist on sound financing and maximum efficiency in production and distribution, whether in this country or abroad.

RICHARD W. PORTER *Assistant Editor, Chemical & Metallurgical Engineering*

Unusual Techniques Feature the Production of SYNTHETIC BEAD CATALYST

Unusual processing methods are used to produce bead catalyst. Forming the beads, in particular, is a new operation worthy of note. Of interest, too, are the techniques and equipment employed to control the quality and properties of the catalyst. Ingenuity of design solved many problems while noncritical construction materials and coatings were used to combat corrosion of process equipment. For a clear idea of the complete process, from raw materials to finished product, see the *Chem. & Met.* pictured flowsheet shown on pages 138 to 141.—*Editors*



Based only on laboratory data, Socony Vacuum's bead catalyst plant at Paulsboro, N. J., was built and operating within six months after ground was broken

CATALYTIC CRACKING has been recognized as one of the most important advances in petroleum refining of the past two decades. In back of this progress, but not so well known, are the strides taken to improve refinery production by making available better catalysts. An outstanding example of catalyst development is the production of synthetic bead catalyst by the Socony Vacuum Oil Co. Inc., at Paulsboro, N. J. Developed for use in the Thermofor catalytic cracking process, this new catalyst was responsible for markedly increasing production of aviation gasoline during the war. The production of synthetic bead catalyst embodies new chemical engineering techniques, and illustrates again the ingenuity and progressiveness of this industry.

It seems quite in keeping with the tradition of the Socony Vacuum Oil Co. to have fathered this development. Outstanding for progressiveness even in an ultra-progressive industry, this company has pioneered in many developments including the installation and operation of the first commercial catalytic cracking plant in this country (Houdry fixed bed type). Having been active in the development and final use of the TCC process, it is natural for this company to have continued its work in improving the catalyst involved. Original catalyst was clay pellets and it was while attempting to improve this material that the new bead catalyst was evolved. The commercial plant was designed and construction begun without benefit of pilot plant experience. Operation started in March 1944 and the design capacity of 50 tons per day was reached in July of that year.

Consisting of activated alumina contained in silica gel, synthetic bead catalyst has now replaced clay pellets in many TCC units and is gaining use in Houdry plants. The important advantage of the synthetic bead over pelleted catalysts lies in its great physical ruggedness, its high and sustained activity, and its low resistance to vapor flow. These important features permit either increased output or a substantial rise in quality level. The over-all advantage of the bead catalyst in terms of increased production, savings in tetraethyl lead, and reduced finishing costs, mark a high standard of performance in the field of catalytic processing.

The process for making synthetic beads is based on the principle that when solutions of sodium silicate and an acid are mixed in the right proportions a gel is formed. Into this gel, a catalytic material, activated alumina, is chemically bound. The gel is readily formed into a desirable shape after which removal of water leaves an extremely porous, active and durable residue. Finished beads average 3 mm. in diameter, are spheroidal in shape, hard, translucent and consist of approximately 89.5 percent silica, 10 percent aluminum oxide, and 0.5 percent water. Beads of about 0.70 bulk density have a particle density of 1.10, a true density of 2.42, a pore surface area of 420 sq. m. per g., and a pore volume of 0.50 cc. per g. Average pore diameter is 47 angstroms or 470 billionths of a centimeter. The large surface area, of course, is made possible by the large number of fine capillaries which permeate the gel structure.

OLD PRINCIPLE—NEW PROCESS

Manufacturing the bead catalysts consists of several steps: (1) Preparing the raw materials into the two gel forming solutions; (2) continuously blending the two solutions in correct proportions and forming the blend into separate drops of gel, each of which becomes a bead after further treatment; (3) wet heat-treating, base exchanging and

Fig. 2—Nearly two billion beads amounting to 50 tons of finished catalyst per day are produced in this battery of individually controlled, lead lined forming towers containing light mineral oil

washing the green beads; (4) drying the treated wet beads by reducing their water content to approximately 10 percent moisture on the bone dry basis; (5) final drying, followed by tempering the dried beads at elevated temperatures; (6) screening, bulk storage, packaging and shipping.

Basic raw materials include silicate of soda, sulphuric acid, aluminum trihydrate and demineralized water. Fluid chemicals are received by barge and pumped to the plant storage tanks, while dry chemicals are received by rail. Ten outside tanks are used for storing fuel (propane for heating the tempering kiln), chemicals, treated water, and for mixing and storage of chemical solutions. Steam for processing and drying is provided by the refinery power plant. Water of the high purity required in the process, free of catalyst poisons such as iron, copper, chromium and sodium, is obtained by demineralizing Delaware River water in a 750 gal. per min. plant, using the cation-anion exchange process.

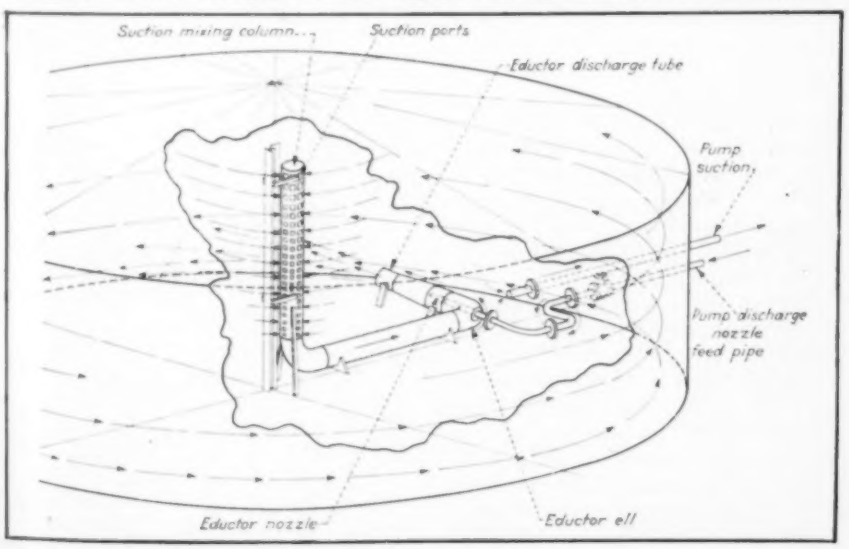
Gel forming solutions consist essentially of sodium silicate and acid-alum. The latter is prepared and handled in lead lined equipment. While the sodium silicate solution is prepared merely by diluting the "N" brand silicate of soda with water, the acid-alum solution is prepared from aluminum trihydrate and sulphuric acid. The aluminum trihydrate is added to 50 percent sulphuric acid and preheated to about 240 deg. F. The reaction is vigorous, exothermic and is maintained at 250 deg. F. by the addition of aluminum trihydrate. The latter part of the reaction involves a digestion period of about 1¼ hr. during which the alum batch is continuously agitated with direct steam and maintained above its solidification temperature of about 210 deg. F. Upon completion, the alum is diluted to a 20 percent concentration which remains liquid at room temperature and which can be safely pumped to the solution preparation tank. Here the 20 percent solution is further diluted to 10 percent and stored for use directly in the base exchange treatment of the wet beads. Sulphuric acid is carefully mixed with this alum solution in the right proportion to produce the acid-alum for the gel forming operation. Aluminum sulphate solution is prepared from the basic raw materials rather than from commercial alum because of the need for high purity.

KEY OPERATION

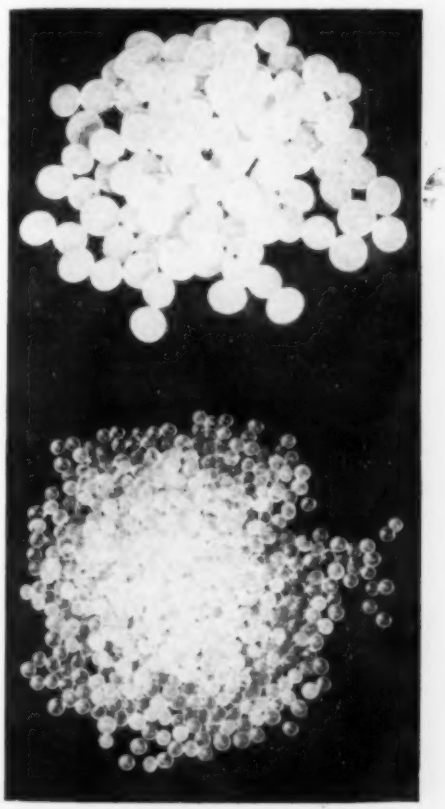
Final preparation and mixing of the solutions takes place in six 42,000-gal. tile-insulated steel tanks, four of which are lead lined (used for alum and acid-alum solutions). In three of these tanks solutions are being prepared while the other three are being emptied for use. They are all equipped with educator mixers, as shown in Fig. 1, developed by Paulsboro engineers for mixing and blending liquids in large tanks.

Key operation of the whole process is forming the beads. The temperatures of both forming solutions are adjusted to optimum values and are then carefully metered to the mixing head on each forming tower. While the actual proportions of the two solutions may be varied to obtain a particular quality of bead, once this is established, it is necessary that the rate of solution be continuously maintained within 0.5 percent in order to form the gel at the required pH. Variations in pH substantially affect the final bead structure as brought about by subsequent processing steps. As the two solutions are mixed, they form a liquid hydrogel or sol which emerges from the nozzle, and distributes evenly over a fluted cone dividing into 60 smaller streams. These flow off the bottom of the cone directly into a layer of light mineral oil, over a bottom layer of water. At about 3 in. below the oil surface the sol breaks into individual droplets averaging ¼ in. in diameter and consisting of 90 percent water and 10 percent solids which gel to form beads as they descend through the oil layer. Approximately 90 million beads per day are produced in a single tower. Complete gelation must take place before the drops reach the oil-water interface to prevent partial dissolving and consequent agglomeration of the beads. At this stage the

Fig. 1—A high eduction to jet discharge ratio, together with the specially designed suction standpipe, insures rapid, thorough mixing of tank contents



Top—Freshly formed beads containing 90 percent water; Bottom—Finished catalyst has a surface area of about 2,000,000 sq. ft. per lb.



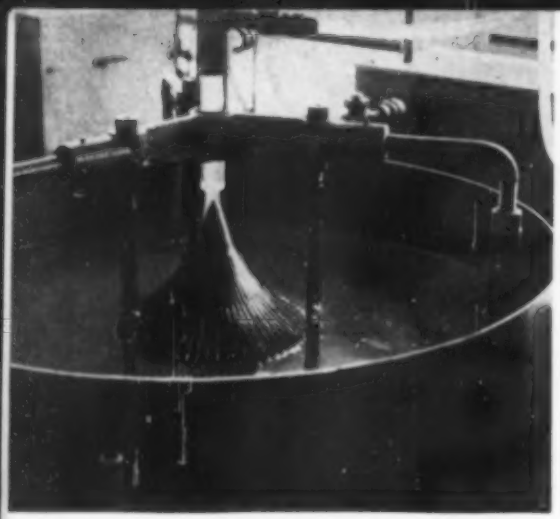


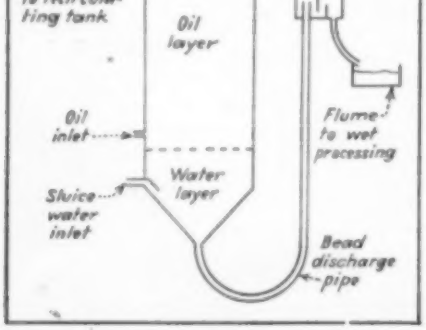
Fig. 3—Liquid hydrogel emerging from the Lucite nozzle is divided by the fluted distributing cone into 60 equal streams which break into droplets forming beads of gel while descending through the oil

beads consist of a tender gel which can be easily crushed or chipped and therefore must be carefully handled.

The complete installation comprises 32 forming towers arranged in two sections as shown in Fig. 2, each consisting of two parallel rows of eight individual units. Each unit operates independently of the others and consists essentially of an automatic flow controller, mixing head, distributing cone, and forming tower. The acid-alum and silicate solutions are pumped to the forming units at constant pressure. Electronic rotameter flow controllers operate a motorized valve on each solution line to maintain a constant rate of flow to the mixing head.

From the control valves the two solutions pass through Saran tubing to the cast bronze mixing head which discharges to the distributing cone through a polished Lucite tube (Fig. 3). Kinetic energy of the high velocity silicate solution entering the low velocity acid-alum stream creates sufficient turbulence to cause thorough mixing of the two components before they emerge as a single stream from the Lucite nozzle.

Fig. 4—Over 20,000 gal. of water per day are used to sluice the 30 tons of freshly formed beads (containing 90 percent water) from each forming tower to the wet processing tanks



The fluted distributing cone with concave surface is made of plaster of paris covered with an anti-wetting resin coating. It contains 60 evenly spaced vertical grooves cast in the surface beginning about three inches below the apex, and increasing in depth to ¼ in. at the base. Since the gel starts forming immediately upon mixing the two solutions, the cone surface must be cleaned manually at intervals of 10 to 15 min. with a multi-prong rubber fork. This prevents unequal distribution due to deposited gel.

Bead-forming towers (Fig. 4) consist of vertical, open top, lead-lined cylindrical tanks, 3 ft. in diameter and 10 ft. deep with a conical bottom tapering to a 3 in. outlet. This contains a 7 ft. deep oil layer and a 3 ft. water layer. Sluice water runs continuously into the lower part of the tank and out the bottom, carrying the beads with it up a riser pipe into an open weir box. The level of the oil-water interface is held constant by adjusting the height of the weir. Fluctuations in the oil level, which must be kept even with the base of the distributing cone, are prevented by adding oil at the rate of about 3 gal. per min., and allowing it to overflow through a level control weir in the tower, and then to a central recirculating surge tank where any water or gel particles are settled out and removed.

WET PROCESSING

Wet or raw beads, continuously removed from each tower, discharge into one of two resin coated steel flumes, 18 in wide, 6 in. deep with a slope of 1 in. per 10 ft. of length, between two rows of eight towers. They meet to form a central flume which runs the full length of the wet processing room and from which the wet processing tanks are filled.

This is accomplished in three stages, namely, hot-water treating, base exchanging, and final washing. The hot-water treatment sets the structure and controls the density of the finished bead. It is important that the concentration of soluble salts in the heat-treating liquor be kept in equilibrium with the soluble salt concentration of the freshly formed hydrogel. The pH of the treated liquor must be accurately controlled within close limits. Unless properly controlled, this treatment lowers the final yield by increasing the proportion of beads fractured during drying operations.

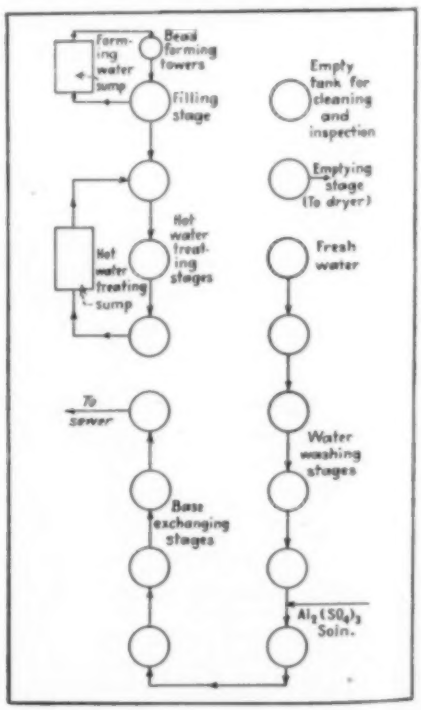
Removal of the zeolitic sodium present in the raw bead is accomplished by base exchanging with aluminum sulphate. The zeolitic sodium is replaced with aluminum. To lower the sodium content from 3½ to 0.2 percent requires aluminum sulphate in the amount of three equivalent weights of the zeolitic sodium present. The effluent from this operation contains appreciable amounts of aluminum sulphate which are discarded.

Final washing, which takes place in about 18 hr. removes sodium sulphate and other soluble salts remaining in the beads. At the beginning, small amounts of a sodium scavenger are added which help to reduce the sodium content to about 0.1 percent or lower. This operation requires about 2.5 volumes of water per volume of hydrogel, or about 15,000 gal. of demineralized water per ton of finished beads. During the wet processing operations, the beads shrink in volume about 10 percent.

Wet processing takes place in 16 concrete tanks set underground to minimize temperature fluctuations due to atmospheric conditions. They are arranged so that the three phases of wet processing take place without moving the beads from one tank to another. As shown in Fig. 5 a typical processing cycle consists of one tank filling, three hot-water treating, five base exchanging, five washing, one discharging to the dryer flume and one undergoing inspection, cleaning or repair. The whole operation is balanced so that when a tank is ready to discharge to the dryers the process in each tank moves ahead one step in the washing, exchanging, hot-water treating and filling operations. Hot-water treating is accomplished in a closed system consisting of three or four tanks in series, a sump and a direct steam heater. The treating liquor is recirculated within the system, thus maintaining as nearly as possible an equilibrium concentration of soluble salts between the liquor and the hydrogel.

Washing and exchanging take place as a multistage countercurrent operation in which

Fig. 5—Three phases of wet processing are accomplished by rearranging the circulation of treating liquors without moving the hydrogel beads



Dryers in this building are capable of evaporating 650 tons of water per day; sluice water is collected in basin and reused

water enters the final tank in the series and passes from one to another of the five tanks in the washing cycle. To the wash liquor is then added the aluminum sulphate solution used for base exchange operation.

Each of the 16 concrete tanks (shown in Fig. 6) has a 45,000 gal. capacity, is 18 ft. deep and 22 ft. in diameter. The bottom slopes to a 4 ft. diameter centrally located pump well. The bead mass which completely fills the tank is supported by a sloping baffle system of five wooden slatted decks located 3 ft. apart vertically, built in sections and hinged at the periphery so that they may be oscillated vertically with a lever to dislodge the hydrogel beads when the tank is being emptied. By supporting the bead mass in this manner, crushing and deforming of the beads is prevented and channeling of the treating liquor and wash water is minimized to provide maximum uniformity of treatment.

UNIQUE DESIGN

Treating liquor or wash water passes through the mass and is removed from the bottom of the tank by 12 collectors consisting of 3 in. lead pipes radiating outward from the center well. The under portion of the pipe is cut away and replaced with an 8-mesh stainless steel screen which holds back the beads but allows free flow of liquor. This provides sufficient screen area to reduce flow velocities, thus eliminating plugging due to forced impingement of beads against the screen. A vertical, axial flow centrifugal pump takes suction at the top of the well and pumps the liquor through a flexible rubber hose to any one of four compartments of a diversion box. Each of these compartments connects to large lead pipelines so that no valves are necessary to divert the flow from one tank to another, to the sewer, or to the hot water, sluice or forming tower sumps.

When final washing is completed, the beads are sluiced out of the tanks through four manually-controlled discharge openings at the base of the center well. It should be noted that beads are not pumped anywhere in the process, but are always sluiced with a moving stream of water. These connect to an 8 in. vertical lead pipe which rises to about 3 ft. below the normal operating level before passing horizontally out the side of the tank (see Fig. 6). An 8-in. rubber hose, which can be raised or lowered to stop or start the flow extends from the tank to the flume which conveys the processed beads to the dryers. Concrete, pyramidal buttresses which fill the "dead spaces" between the discharge openings aid in directing the bead flow to the individually controlled discharge gates. Water is added to maintain the operating level and the beads flow to the outlets and up a vertical discharge pipe to the flume.

While this system readily removes most of the beads from the tank, it becomes less effective as the tank becomes nearly empty. A unique airlift system was designed to accomplish the complete removal necessary. It consists of two annular walls, one 4 in. inside the tank wall extending from a few inches below the normal operating level in the tank to within 10 in. from the bottom. The second wall is 6 in. inside the first one extending from a few inches above the normal liquid level down to 3 ft. below it. Between the two walls and near the bottom of the second is suspended a 3 in. perforated pipe for introducing low-pressure air which raises the liquid in the annular space to a level higher than in the rest of the tank. This air-lift action induces large volumes of water to circulate at low velocity down between the tank wall and the first annular wall and along the bottom of the tank toward the discharge gate. This movement of water causes any remaining beads to flow away from the tank walls across the bottom towards the center where they are picked up by the water stream leaving the outlet gates.

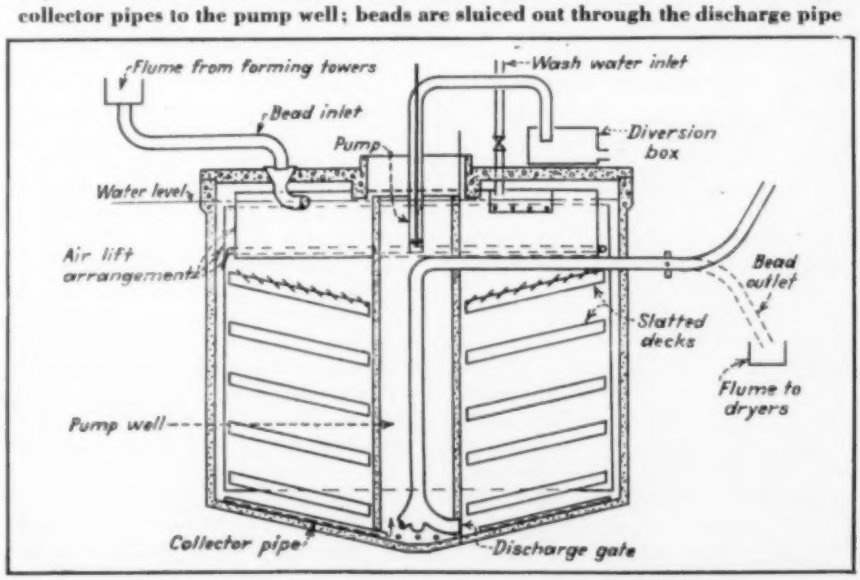
DRYING

Completely processed beads are drained of excess water and mechanically spread to a depth of 3 to 3½ in. on perforated stainless steel dryer belts in a tunnel dryer. Drying time averages about four hours at a temperature of about 280 deg. F. for the first three hours, and increasing to 300-350 deg. F. for the last hour. Drying takes place in a 100 percent steam atmosphere to prevent the beads from drying too fast and bursting. Beads shrink in drying to approximately 1/11 of their original volume, during which operation substantial stresses are set up in the gel structure, particularly during the latter part of the drying operation when drying occurs by diffusion of the water vapor through the bead capillaries to the surface. It is important that the temperature and relative humidity be maintained uniformly to prevent undue fracturing of the beads. Beads containing about 10 percent moisture (bone dry basis) discharge from the dryer conveyor to a hopper and then to the tempering operation.

Wet beads are scooped from the feed trough by perforated dryer feed elevator buckets which drain excess water from the beads. A tilting device causes alternate buckets to dump into the top or bottom dryer feed chutes. The chutes are designed to act as steam seals and hoppers for smoothing out any irregularities in the feed and an adjustable gate at the bottom of the chute regulates the depth of the beads on the conveyor belt.

Drying takes place in three main units, 150 ft. long, each consisting of two adjacent tunnel dryers separated by a central corridor. Each of these tunnels is divided into an

Fig. 6—Beads rest on slatted decks while treating liquors are drawn through collector pipes to the pump well; beads are sluiced out through the discharge pipe



upper and lower section containing an endless stainless steel dryer belt 9½ ft. wide, perforated with $\frac{1}{16}$ in. by ½ in. slots. Every conveyor travels through seven drying compartments, each of which is equipped with steam-heating coils and an automatic temperature controller. Low-pressure blowers recirculate the drying medium over the finned heating coils, through the bead bed and perforated conveyors. The total drying surface of all 12 dryer belts is approximately 15,000 sq. ft., with a drying capacity of 60 tons per day of finished beads. This corresponds to an evaporation rate of nearly 650 tons of water per day. Any one or any combination of the dryer conveyors may be operated at one time to match the output of the bead forming and the processing operation.

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The vibrating screen, consisting of a tie-rod screen with 1-in. long slots and made from 0.035-in. steel wire satisfactorily removes the fines from the good beads without plugging or fouling. Both the beads and fines are stored in concrete tanks or silos with a capacity for 650 tons of beads and 200 tons of fines. The bottom of each silo discharges to an automatic filling and weighing machine where the beads are packaged in 5-ply moistureproof self-sealing bags containing 70 to 80 lb. each.

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There is no great cause for wonder that such a state of affairs exists, since very little information of this sort is available in the literature. Furthermore, the practical operator is so busy holding his kiln operations up to their present standards that he has little, if any, time to give to the problem, in studying and correlating the facts he has accumulated.

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processed and other circumstances attending the kiln operation.

The relation in Equation (1) represents very closely results that generally obtain in practice, providing the ratio of L/D is not exceedingly large. Coefficient k remains practically constant for L/D ratios between 15/1 and 25/1. Since most rotary kilns in industry today are dimensioned within this range, the relation as presented can be applied with good practical accuracy.

If the physical dimensions of the kiln are related as:

$$R_k = L/D \text{ and } L = R_k D \qquad (2)$$

then (1) becomes:

$$Q_d = \frac{k D^3 L}{100} = \frac{k R_k D^3}{100} \qquad (3)$$

When burning dry, suitably sized limestone particles to good quality lime in rotary kilns without heat-exchange devices in or at the feed end of the kiln, and discharging the lime from the kiln at 2,200 deg. F. (which is about normal), the value of the production coefficient k has been observed to be 1.5 with very good kiln operating practice.

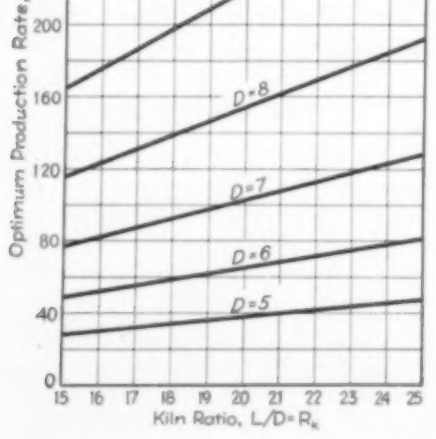
For dry-feed lime burning, Equation (3) then becomes:

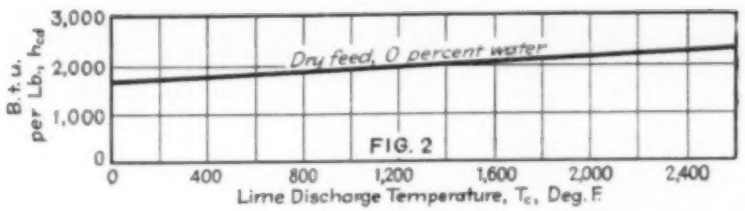
$$Q_{dd} = \frac{1.5 R_k D^3}{100} \qquad (4)$$

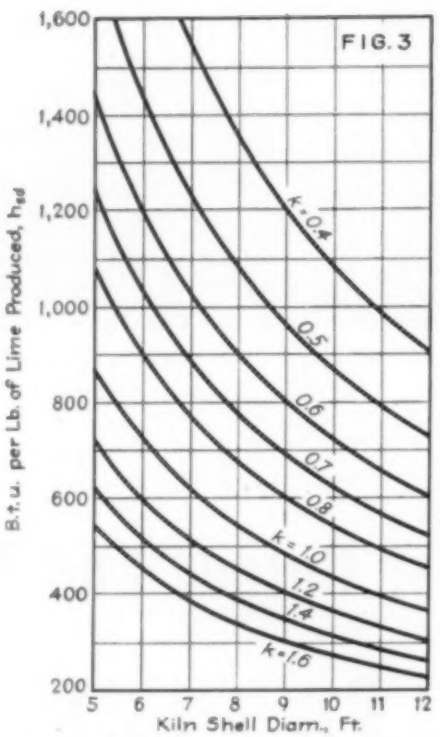
where Q_{dd} is the optimum daily production rate for dry-feed rotary kilns burning lime.

Table I tabulates the relations in Equation (4), while Fig. 1 shows the same relations graphically.

Fig. 1—Optimum production rate of dry-feed lime kilns for various L/D ratios and kiln diameters (Table I)







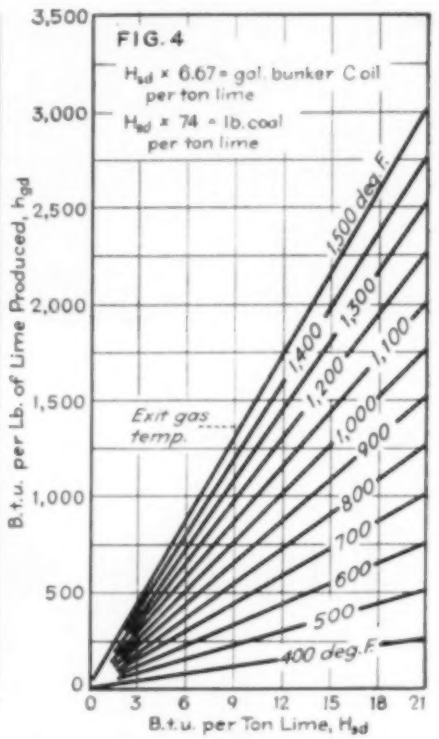


Fig. 2—Heat per pound of lime produced required for preheating, calcining and superheating dry feed for various lime discharge temperatures

Fig. 3—Heat per pound of lime produced lost through kiln shell for various values of kiln diameter and coefficient k

Fig. 4—Heat per pound of lime produced carried out in exit kiln gases from dry-feed kilns at various fuel-throughput ratios and various exit temperatures

HEAT UTILIZATION

In a previous article (*Tech. Ass'n. Papers*, T.A.P.P.I. Series 28, p. 152, Sept. 6, 1945) the writer discussed the heat requirements of the various items demanding heat in rotary kiln operations burning lime sludge in paper mills recovering lime.

The total heat required by the operation is apportioned to calcining the material to a satisfactory degree, and supplying the attending heat losses. These heat losses are: (*a*) That heat escaping with the exit kiln gases, (*b*) heat escaping through the wall of the kiln, and (*c*) heat lost in the hot lime discharged from the system. Thus

$$h_{rd} = h_{cd} + h_{sd} + h_{ed} \qquad (5)$$

where h_{rd} is the heat required to produce 1 lb. of lime with the dry-feed kiln, B.t.u. per lb.; and h_{cd} is the heat required to calcine 1 lb. of lime and discharge it from

Table I—Optimum Production Rates in Tons per Day for Rotary Lime Kilns Using Dry, Sized Feed

	Kiln Diameter, Feet					
R_k	5	6	7	8	9	10
15	28.2	48.6	77.4	115.4	164.2	225.0
16	30.0	51.8	82.4	123.0	175.0	240.0
17	31.9	55.1	87.5	130.9	185.9	255.0
18	33.8	58.4	92.7	138.5	196.9	270.0
19	35.7	61.5	97.8	146.0	208.0	285.0
20	37.5	64.9	102.9	153.7	219.6	300.0
21	39.4	68.0	107.9	161.3	230.0	315.0
22	41.3	71.4	113.3	169.0	241.0	330.0
23	43.1	74.7	118.3	177.0	252.0	345.0
24	45.0	77.9	123.5	184.9	263.0	360.0
25	46.9	81.2	128.5	192.0	274.0	375.0

Table II—Millions of B.t.u. per Ton Lime That Must Be Supplied for Normally Operated Dry Feed Kilns With Exit Gas at 2,200 Deg. F.

	Kiln Diameter, Feet					
R_k	5	6	7	8	9	10
15	6.78	6.74	6.78	6.86	6.98	7.15
16	6.68	6.62	6.65	6.71	6.81	6.95
17	6.60	6.53	6.54	6.58	6.67	6.78
18	6.52	6.45	6.44	6.46	6.53	6.63
19	6.45	6.37	6.36	6.37	6.43	6.51
20	6.39	6.30	6.28	6.29	6.33	6.40
21	6.34	6.24	6.22	6.21	6.25	6.31
22	6.29	6.19	6.15	6.15	6.17	6.23
23	6.25	6.14	6.10	6.10	6.10	6.15
24	6.21	6.10	6.05	6.03	6.04	6.09
25	6.18	6.06	6.01	6.00	6.00	6.03

the system at some temperature, T_e, B.t.u. per lb. h_{sd} is the kiln shell heat loss for each pound of lime produced with dry feed, B.t.u. per lb.; and h_{gd} is the heat lost in the exit kiln gases, B.t.u. per lb. of lime produced with dry feed.

HEAT FOR CALCINATION

Fig. 2 shows the computed total quantity of heat involved in preheating, calcining and superheating the lime from dry feed to produce 1 lb. of lime. The relations are:

$$h_{cd} = 0.25\ T_e + 1,630 \qquad (6)$$

where T_e is the temperature, deg. F., at which the lime is discharged from the system.

It will be noted that T_e has been so chosen and defined as to absorb the heat loss in the discharged lime as part of the heat requirement for calcination. No great error is involved in so doing. However, if the lime is cooled by air being preheated for combustion and this is done external to the kiln, some error will be involved in assuming the coolers to be 100 percent thermally efficient in effecting the exchange of heat.

KILN SHELL LOSS

An empirical relation for the kiln shell heat loss has been proposed by the writer (*Tech. Ass'n. Papers*, T.A.P.P.I. Series 28, p. 152, Sept. 6, 1945) as follows:

$$h_{sd} = 4,340/k\ D \qquad (7)$$

or when k is 1.5 this becomes:

$$h_{sd} = 2,890/D \qquad (8)$$

Fig. 3 shows the kiln shell heat loss, from this relation, for kilns of various diameters and different values of k.

EXIT GAS LOSS

Fig. 4. shows graphically the computed heat carried from the system by the exit kiln gases under dry-feed conditions for various heat-lime ratios and exit kiln gas temperatures. These data are rather closely correlated by:

$$h_{gd} = 35.4\ H_{sd}\ (0.00334\ T_{gd} - 1) \qquad (9)$$

where H_{sd} is the heat supplied to the system, millions of B.t.u. per ton of lime produced from dry feed; and T_{gd} is the temperature of the gases leaving the dry-feed kiln, deg. F.

EXIT GAS TEMPERATURE

In another paper presented by the writer, he proposed an empirical relation (*Chem. & Met.*, April 1944, p. 106) for computing the normal exit kiln gas temperature with dry feed. This relation is:

$$\text{Log}\ T_{gd} = 3,623 - 10\left(\frac{L - 5D}{D^3 + 10L}\right) \qquad (10)$$

In this form the relation is unwieldy for the present use, and the writer proposes to use in its place a modified form such as:

$$T_{gd} = \left(\frac{4,700 + 1,550D}{R_k}\right) + 287 \qquad (11)$$

Thus Equation (9) becomes:

$$h_{gd} = 35.4\ H_{sd}\left(\frac{15.7 + 5.18D}{R_k} - 0.04\right) \qquad (12)$$

TOTAL HEAT REQUIREMENTS

With the relations presented for h_{cd}, h_{sd} and h_{gd}, the component parts of h_{rd} are available, and can be equated as follows (as in Eq. 5):

$$h_{rd} = (0.25\ T_e + 1,630) + \frac{2,890}{D} + 35.4\ H_{sd}\left(\frac{15.7 + 5.18D}{R_k} - 0.04\right) \qquad (13)$$

Since, by definition:

$$1,000,000\ H_{sd} = 2,000\ h_{rd} \qquad (14)$$

Then

$$500\ H_{sd} = h_{rd} \qquad (15)$$

Or

$$500\ H_{sd} = (0.25\ T_e + 1,630) + \frac{2,890}{D} + 35.4\ H_{sd}\left(\frac{15.7 + 5.18D}{R_k} - 0.04\right) \qquad (16)$$

Which reduces to

$$H_{sd} = \frac{0.25\ T_e + 1,630 + 2,890/D}{501.4 - (556 + 183.3D)/R_k} \qquad (17)$$

Thus, knowing the diameter and length of the dry-feed kiln, and the temperature at which the lime is discharged from the system, the normal heat requirement per ton of lime produced can be computed.

Table II is a tabulation of Equation (17) while Fig. 5 shows graphically the average of the relations. The tendency for kilns with the larger values of R_k to have a reduced heat requirement per ton of product is well pronounced. No doubt the information given here can be used to establish the most economical R_k for any kiln under specific conditions.

With the heat requirement per ton of lime for a normally operated dry-feed rotary kiln established, and with the production rate known, the normal time-rate of firing fuel or supplying heat can be determined from previous relations. Since by Equation (4) $Q_{sd} = 0.015 R_k D^3$, then:

$$Q_{hd} = \frac{0.015\ R_k\ D^3}{24} = 0.000625\ R_k\ D^3 \qquad (18)$$

where Q_{hd} is the normal tons of lime per hour produced by the dry-feed kiln. The normal time-rate heat requirement H_n then will be:

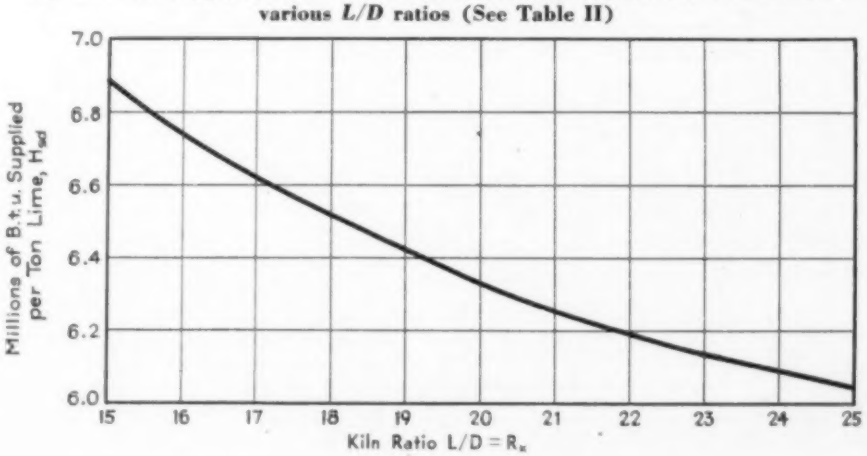
$$H_n = Q_{hd}\ H_{sd} \qquad (19)$$

$$= 0.000625\ R_k\ D^3\ H_{sd} \qquad (20)$$

$$= 0.000625\ R_k\ D^3 \left(\frac{0.25\ T_e + 1,630 + 2,890/D}{501.4 - (556 + 183.3D)/R_k}\right) \qquad (21)$$

Thus the normal time-rate heat requirement that must be provided for in a normally operated dry-feed lime kiln can be approximated by knowing the physical dimensions of the kiln and the temperature at which the lime is discharged from the system.

Fig. 5—Heat supply per ton of lime produced required for dry feed kilns of various L/D ratios (See Table II)



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RUBBER & PLASTICS

As Materials of Chemical Plant Construction

Synthetic rubber and plastics are valuable materials of construction, but to use them profitably you must use them correctly. There are many types and each has its province. This article is designed to act as a guide in their selection; it discusses each of the important types, points out the strength and weakness of each and describes some typical applications.—*Editors*

PART I – SYNTHETIC RUBBERS

THERE ARE five "commercial" types of synthetic rubber; they are listed in Table I. (Notice that only vulcanizable materials will be considered as synthetic rubber; other "rubber-like" materials will be discussed later as plastics.) Table I also gives a comparison of the "chemical" and "physical" properties of natural and synthetic rubbers. This comparison is only general: properties and performance can be varied considerably by processing, by compounding, and by varying the proportions of the constituents used. Here are two general conclusions.

1. Natural rubber usually has better physical characteristics.
2. Synthetic rubber usually has better resistance to deterioration.

A table on the resistance of synthetic rubber to acids and alkalis is not included. Such a table would be quite complicated and necessarily incomplete because of the paucity of data available. We will cover this aspect of the discussion by describing actual applications in chemical plants.

GR-S (BUNA-S)

GR-S (copolymer of butadiene and styrene) is being made in by far the largest quantity and it has been the most generally available synthetic rubber. This and favorable plant experience have shown that GR-S has been a "life saver" during the war period as far as rubber equipment in the chemical plant is concerned. It has been a satisfactory alternate for natural rubber in many cases involving acids, alkalis, water, and other process solutions. Experience shows that it is quite safe to install GR-S for any service where natural rubber has been used successfully; the exceptions to this rule during the last two years have been few and minor.

GR-S was extremely helpful for another reason. It could be made into items previously made of rubber, such as linings, roll coverings, and molded parts. In most cases the old molds were entirely satisfactory. All these items have been produced from GR-S in both the soft and hard conditions. A year or so ago the softer compounds were not available but the hardness range is now well covered, as shown in Table I.

One of the first tanks of commercial size to be lined with GR-S was field lined with soft sheet in one of our plants during October, 1943. This tank was 16 ft. in diameter and 16 ft. high. Similar tanks were lined immediately afterward to make a total of about a dozen. They handle concentrated hydrochloric acid containing small amounts of chlorine at slightly over atmospheric temperature. Strip tests were pulled from the wall of one tank after four months and again after seven months; no loss in adhesion was observed. Tensile tests on these strips showed a strength of 960 psi. A slight surface hardening, typical also of rubber in hydrochloric acid and chlorine, was observed. More recent inspection showed that the tank lining was still in good condition, including the patches on the stripped areas. Incidentally, a natural rubber lining in similar service showed a very large number of blisters after 32 months. This case, however, should not be regarded as representative for natural rubber in this service.

Several hundred thousand square feet of GR-S linings have been installed in tanks, lines, and valves handling process water and dilute sulphuric acid. In one plant, pipe up to 42-in. dia. was lined with semi-hard GR-S (85-90 Durometer). GR-S gaskets were used in these lines, which were successfully tested at 200 psi.

The following items involving GR-S, with length of service to date, have been in operation in rayon and cellophane plants:

1. Coal filters. 1.5 years.
2. Evaporator bodies. 1.5 years.
3. Crystallizers (soft GR-S lining). 2 years.
4. Agitators. 2 years.
5. Nutsche tanks. 1 year.
6. Wash rack manifolds. 1.5 years.
7. Roll coverings (transfer, squeeze, and quetsch rolls). 1.5 years.
8. Six-inch lined valve. 9 months.
9. Hard rubber wash pans. 2 years.
10. Hard rubber pipe and fittings. 1.5 years.
11. Hard rubber cocks. 1 year.
12. Cake rods (rubber-covered metal tubing). 1.5 years.
13. Candle filters.
14. Miscellaneous gaskets.

Items 1-8 are steel or cast iron covered or lined with sheet GR-S. Items 9-13 are

Selected References

1. Anon., *Chem. Industries*, March 1945.
2. E. R. Bridgewater, *Trans.* AIChE, 1939, pp. 435-446.
3. T. S. Carswell and R. U. Haslanger, *Trans.* AIChE, 1943, pp. 755-767.
4. E. I. du Pont de Nemours & Co., *Ind. Eng. Chem.*, 1936, pp. 1160-1163.
5. H. E. Fritz and J. R. Hoover, Am. Soc. Testing Materials reprint, 1932, 17 pp.
6. F. C. Hahn, M. L. Macht, and D. A. Fletcher, *Ind. Eng. Chem.*, 1945, pp. 526-533.
7. G. M. Kline, R. C. Rinker, and H. F. Meindl, *Modern Plastics*, 1941, pp. 59-66, 88.
8. "Plastics Catalog," New York, Plastics Catalogue Corp., (1945)
9. C. A. Rauh, *Trans.* AIChE, 1939, pp. 463-472.
10. F. K. Schoenfeld, *Trans.* AIChE, 1939, pp. 447-462.
11. H. R. Simonds, M. H. Bigelow, and J. V. Sherman, "The New Plastics," New York, D. Van Nostrand Co., Inc. (1945).
12. D. E. Strain, R. G. Kennelly, and H. R. Dittmar, *Ind. Eng. Chem.*, 1939, pp. 382-387.
13. D. R. Williams, *Chem. & Met. Eng.*, Nov. 1945, pp. 112-113.

* This paper was presented before the American Institute of Chemical Engineers, Chicago, Dec. 19, 1945; since its preparation Dr. Fontana has left the Du Pont Co. to become professor of metallurgical research at Ohio State University.

molded parts. The above equipment operates in contact with a variety of process solutions including rayon coagulating bath, desulphuring, bleach, size, and softener solutions at temperatures in the range 20-140 deg. F. The rayon bath contains about 10 percent sulphuric acid along with sodium sulphate, zinc sulphate, and various sulphides.

The candle filters, Item 13, handle viscose under pressure. Hydraulic bursting tests on GR-S showed strengths equivalent to natural rubber for filters made in the same molds.

Tank cars lined with GR-S are used for hydrochloric acid, latex, formaldehyde, and phosphoric acid. Large formaldehyde storage tanks were lined with it in 1942. Paper pulp washing machines have been lined and covered. Other items include hose and tubing for a variety of services; one of the tubing applications concerns Moore filter equipment where the tubing is in contact with sulphuric acid up to 30 percent concentration at 125 deg. F.

Small parts can now be covered with hard or soft GR-S by the dipping process, but little experience is available to date.

The temperature limitations on GR-S linings are the same as those generally used for natural rubber: 150 deg. F. for soft and 180 deg. F. for semi-hard or hard linings.

Table I – Properties of Natural and Synthetic Rubbers

"Chemical" Properties	Natural Rubber	GR-S (Buna-S)	GR-A (Buna-N)	GR-M (Neoprene)	GR-I (Butyl)	GR-P (Thiokol) (Polysulphide)
Resistance to:						
Air	F	G	G	E	E	E
Ozone	P	P	F	E	E	E
Sunlight	F	F	P	E	E	E
Aliphatics	P	P	E	E	P	E
Aromatics	P	P	F	P	P	E
Heat	G	G	VG	VG	F	F
Cold*	VG	VG	G	G	G	F
Vulcanizability	VG	VG	VG	VG	F	F
"Physical" Properties						
Tensile	E	G	G	G	G	F
Tear	VG	F	F	G	G	F
Abrasion	VG	G	G	G	F	P
Hardness, Shore-A	20-H	30-H	20-H	20-75	30-75	30-75
Resilience	E	G	F	VG	P	G
Molding	E	G	VG	E	F	F
Gas impermeability	G	G	G	VG	E	E
Water impermeability	G	G	G	G	VG	VG
General processability	E	F	F	G	G	F
Electrical properties	E	E	F	F	E	F

Key: E = excellent; VG = very good; G = good; F = fair; P = poor; H = hard.
Note: Special purpose synthetics which are modifications of the above are also produced; some of these are Chemigum, Ameripol-D, Hycar, Perbunan (all modifications of GR-A), and Neoprene-FR.
*This property can be varied considerably through compounding.

BUTYL

Butyl (copolymer of isobutylene and a diolefin) rubber has been used almost exclusively for the manufacture of inner tubes during the war period. Few developments have been made with regard to materials of construction. In one respect butyl is unique in the field of natural and synthetic rubbers: it possesses good resistance to nitric acid. This characteristic should result in many applications in the chemical plant.

GR-A (BUNA-N)

The two outstanding properties of GR-A (copolymer of butadiene and acrylonitrile) are its resistance to aromatic solvents and heat. During the last two years of the war, GR-A was generally not available for chemical plant work and accordingly few new uses were developed for it.

One application where it is performing well while all other tried materials failed concerns wash chuck gaskets in the washing of acid from rayon cakes. These U-shaped circular gaskets handle water, dilute sulphuric acid, and some hydrogen sulphide and carbon bisulphide at 140 deg. F. Natural rubber and other synthetics failed primarily because of excessive swelling. GR-A gaskets have been used in this service for over three years.

A large number of GR-A sleeves for roll coverings have been used for several years in contact with dilute sulphuric acid, wash water, bleach, and other solutions. Fabrication or molding difficulties were encountered in connection with these sleeves. Roll coverings made by wrapping sheet stock of GR-A are also used. Quetsch rolls in the rayon plants are covered with it. GR-A rolls used in the processing of nylon thread are in good condition after two years' service. A large number of rolls covered with GR-A are being used in the printing industry because resistance to the solvents in inks is required. Rolls for applying wax to paper have been covered with GR-A.

Steel tanks lined with GR-A are being used in the petroleum industry to handle hydrochloric acid containing hydrocarbons. For conditions involving resistance to both mineral acids and aromatics, one of the modifications of GR-A, such as Hycar, is often preferred. GR-A hose is used in some quantity in the oil industry. Hard GR-A compounds became available recently and should find considerable application, for example, in molded parts for handling aromatics. Small valve stems machined from hard GR-A are now being tried in one of our plants.

THIOKOL

The outstanding properties of Thiokol (organic polysulphide) are its resistance to aliphatic and aromatic solvents. Thiokol also shows excellent impermeability to gases. It has been used extensively for lining concrete and steel storage tanks for aviation gasoline and is also used for printers' blankets and printers' rolls. Thiokol does not possess good cold flow characteristics.

A substantial quantity of Thiokol is applied by the flame-spraying process for covering steel equipment, particularly for protection against salt water. In general, however, it is less resistant to acids and alkalis than some of the other synthetics and natural rubber. Our experience with Thiokol in the chemical plant has been quite limited.

NEOPRENE

Neoprene (polymer of chloroprene) had been in commercial use for ten years prior to Pearl Harbor and would have been immediately useful to the chemical industry had it not been for restrictions imposed upon its distribution. Neoprene was one of the first five materials (four were metals) placed on allocation.

Neoprene closely resembles soft vulcanized natural rubber in physical properties and accordingly can be used where the physical characteristics of natural rubber are required. Neoprene has been used in many places in chemical plants where its chemical properties were not required. Rubber-covered squeeze rolls are a good example; neoprene was used because GR-S compositions having the desired strength and toughness could not be commercially produced in a hardness below 40 Durometer. However, recent advances in compounding technique have improved the properties of such compositions. Numerous other examples include gaskets and soft molded parts.

Neoprene cannot be made into a hard rubber and accordingly cannot be used for hard molded parts such as hard rubber pipe and fittings. And note that neoprene possesses favorable properties for all the items listed in Table I except for electrical properties and resistance to aromatics. Neoprene has been most valuable for its resistance to heat and its resistance to aliphatic hydrocarbons. The adhesives used to bond neoprene to steel also show good heat stability.

One of the chief uses has been in belting for conveying materials. In one case,[1] neoprene-impregnated glass cloth belting has been reported as being used for handling a chemical (not identified) at 300 deg. F. Considerable flexing and contact with oil was involved. Rubber-covered cotton belts lasted six weeks but most of the neoprene-glass

Table II – Effect of Exposure to Distilled Water on Natural and Synthetic Rubber Linings

Material	pH of Water		Initial Tensile Strength, psi.	After Exposure		
	Start	End		Tensile Strength, psi.	% Elongation	Adhesion to concrete, lb./lineal inch
Neoprene (sheet)	6.6	7.2	1,400	1,400	540	30
Neoprene KNR	6.6	4.7	1,200	...	...	6
Natural rubber (cured sheet)	6.6	8.2	2,100	1,700	640	4
Natural rubber (cured after lining)	6.6	7.5	1,900	1,300	520	10
Thiokol	6.6	6.7	650	350	200	6

belts showed a service life of seven months.

Neoprene sheet lining in the hot end of a rocker crystallizer handling alum showed a life of four years; the temperature of the liquor in contact with the neoprene is 180-205 deg. F. Natural rubber is satisfactory for the cold end of this long crystallizer but not for the hot end.

Neoprene-covered fans are used on gases at 200 deg. F. from a Cottrell precipitator; the fan is in contact with 10-20 percent sulphuric acid mist and sulphur gases. Another neoprene-covered fan showed a life of approximately three years handling hot hydrochloric acid fumes in a plant making this acid. A blender agitator covered with neoprene showed a more economical life than natural rubber for handling a pigment slurry at 175 deg. F. Neoprene-covered filter frames showed three times the life of natural rubber when in contact with a slurry containing an "organic treating agent."

Small flexible ducts and flexible tubing made from combinations of neoprene and asbestos cloth or glass cloth are claimed to be resistant to temperatures up to 400 deg. F. Neoprene gloves are widely used. A large quantity of neoprene-impregnated cotton sheeting was used to seal the side walls to the floating tops of large tanks handling deaerated water. A host of other uses include linings for hydrofluoric acid, roll coverings, and tank linings. For additional information on neoprene, we suggest a previous paper.[9]

Another form of neoprene used in the chemical industry is the "brush-type." This is applied by brushing, spraying, or dipping, and it gives an inexpensive lining because it can be applied in thin layers. Brush-type neoprene has been used for lining tanks, lines, and valves for handling a variety of process liquors. Tank cars lined with brushed neoprene are being used for shipping 70 percent caustic, which is loaded at approximately 200 deg. F. Neoprene putty and troweling compounds are also available.

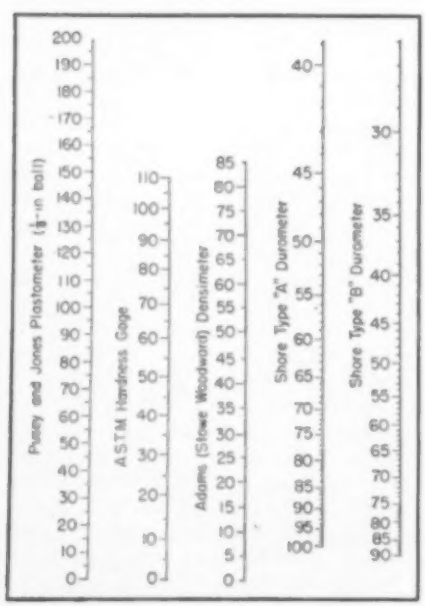


Fig. 1—Comparison of hardness scales; for equivalent hardness read horizontally

RUBBER IN GENERAL

As a result of unfavorable reports on the performance of natural rubber when handling distilled water, a series of tests was made on concrete buckets lined with two natural rubber stocks, neoprene, and Thiokol. Apparently, the chief difficulty had been due to water penetrating the lining and destroying adhesion with subsequent formation of blisters. The concrete buckets were filled with distilled water and exposed for 14 months at room temperature. The data obtained are shown in Table II. Note that neoprene alone suffered no loss in strength. Data on adhesion prior to exposure were not obtained but the indications are that adhesion was decreased for all the materials except perhaps neoprene.

A conversion chart for the several methods of determining hardness is shown as Fig. 1; it will be helpful to the chemical engineer interested in the use of rubber equipment. Here are some Type-A Durometer hardnesses for familiar materials: Art gum 25, tire tread about 60, sole leather (about the same as semi-hard rubber linings) 85-90, and hard rubber 100.

For use as a guide in the selection of rubber for a given service, we suggest reference[8] which points out the resistance of rubber (natural only) to a large number of chemicals. (Keep in mind the information supplied above on comparative properties of natural and synthetic rubber.)

PART II – PLASTICS

A number of new plastics have been developed during war years and many applications have been found in chemical plants. A previous paper[6] contains data on physical and mechanical properties of plastics and information on chemical applications. Numerous data on the resistance of plastics to chemicals are given in a reference.[7]

PHENOLICS

The phenol-formaldehyde or Bakelite-type resin was one of the first plastics developed and practically everyone is familiar with it. Phenolics are available as molded parts, rods, sheet, tubing, and pipe. Generally speaking, the phenolics show good resistance to acids but poor resistance to alkalis.

Thousands of spinning buckets are used in the manufacture of rayon; they are usually molded and the resin is reinforced with woven cloth. Resistance to sulphuric acid and good strength are required. Tests were made to determine the effect of long exposure and the data obtained are shown in Fig. 2. Notice that all of the materials except the glass cloth laminate show a substantial drop in impact and tensile strength after a few months' exposure. The glass cloth showed a surprising effect in that the strengths increased. The tests were repeated under somewhat different conditions, but the same effect was observed.

A relatively new use for the phenolic resins involves 10- and 12-ft.-dia. fans for water cooling towers. Numerous fatigue failures of "light metal" cast blades occurred. The metal blades were replaced with "compregnated" wood about three years ago and excellent results obtained. The blades are made by treating strips of wood with a phenolic resin and then forming under pressure in a mold. Hollow fan blades made by the "bag-molding" process and solid blades containing a cloth base have since been made and good performance reported.

Phenolic bearings are frequently used where lubrication is difficult. Tests of nine months' duration were made on combinations of bearings and trunnions made of phenolic resin and bronze. The phenolic lasted several times longer than the "acid" bronze. These were actual service tests in a plant machine. The bearings were lubricated with dilute sulphuric acid at 190 deg. F.

Pump impellers made by molding a phenolic resin on a steel spider have given good service in contact with acids. Other uses for the phenolics, wherein acid resistance is required, are rollers, heat exchanger tube inserts, casters, gears, bolts, tank baffles, doors, wash chucks, brackets, splash guards, pipes, and valves.

Baked phenolic coatings are extensively used for tanks and pipe lines. Phenolic

lined tank cars are used to ship formaldehyde, latex, nylon intermediates, and sulphuric acid. A glauber's salt crystallizer was coated to avoid iron contamination and the coating served its purpose, but it also doubled the capacity of the equipment because the crystals did not adhere to the smooth coating.

VINYLS

Vinyl resins are important because resins such as polyvinyl chloride possess good resistance to both acids and alkalis. These materials can be "heat-sealed" or joined by heating. The vinyl resins, however, do not show good heat resistance and for continuous operation are generally limited to 170 deg. F.

Saran, a vinyl chloride-vinylidene chloride copolymer, is widely used in the chemical industry and several actual applications may be of interest. Two 2-in. pipelines, one handling hypochlorite bleach and the other solutions of sulfamic acid, have been in service for over one year. A large number of injection-molded spinneret adapters have been used for over two years in rayon plants; these are in contact with an alkaline liquid on the inside and with acid rayon bath on the outside. Oil feed tubes for lubricating moving parts have been used successfully. Saran is used in many cases as an alternate for copper tubing. Fabrication, forms available, and some more applications for Saran pipe are given in a reference.[18]

Vinyls are used in the chemical industry as hose and tubing, protective paints, gloves, aprons, valve diaphragms, tank linings, motor cords, and belts. Vinyon has found wide application as a filter cloth material. Tygon linings were installed in large steel tanks handling hydrochloric acid in a magnesium producing plant. Pyroflex is used as an intermediate lining between brick and steel for boiling and concentrating tanks handling chemicals such as zinc sulphate and ammonium chloride. Pyroflex[9] and Koroseal[10] have been discussed in previous papers.

NYLON

Wartime restrictions on nylon have prevented its full exploration as a material of construction but its properties indicate that it may find considerable application in this field. Some of the desirable properties are as follows: high strength and excellent toughness of molded parts; heat resistance; good resistance to oil, grease, and solvents such as aromatic gasoline and chlorinated solvents; and resistance to alkalis. Tests in 60 percent caustic at 240 deg. F. for 8 hr. showed no visible effect on nylon.

A large number of nylon bushings installed in rayon spinning buckets showed good performance, as did bushings made of phenolic-impregnated nylon cloth. Nylon should be a desirable bearing material where low loads and poor lubrication (for example, water) are involved. Nylon has promise also for gaskets, filter cloth, and thin extruded tubing. The tubing is expected to find considerable use as a tough flexible tubing for resistance to oils and heat.

Table III – Effect of Various Chemicals on Polythene
(After three months' exposure at room temperature)

	On Removal from Reagent		After 24 hr. Conditioning at Room Temp.		
	Change in Wt., %	Appearance	Tensile Strength, psi.	Elongation, %	Resistance Rating
Inorganic Acids and Bases					
H_2SO_4, conc.	+ 0.13	No change	1,458	462	E
H_2SO_4, 10%	+ 0.04	No change	1,370	483	E
HCl, conc.	+ 0.13	No change	1,406	258	G
HCl, 10%	+ 0.20	No change	1,442	336	E
HNO_3, conc.	+ 3.02	No change	1,093	71	F
HNO_3, 10%	+ 0.22	No change	1,387	325	E
NaOH, 50%	+ 0.13	No change	1,432	313	E
NH_4OH, conc.	+ 0.31	No change	1,378	371	E
Oxygenated Organic Compounds					
Ethanol (denatured)	— 0.02	No change	1,550	421	E
Acetone	+ 0.03	No change	1,363	379	E
Ethyl acetate	+ 2.76	No change	1,295	325	E
Dioxane	+ 0.38	No change	1,368	382	E
Butyraldehyde	+ 3.06	No change	1,245	417	E
Linseed oil	+ 0.88	No change	1,410	483	E
Triethanolamine	+ 0.08	No change	1,408	379	E
Camphor oil	+17.42	Swollen	1,375	483	G
Hydrocarbons					
Ethyl gasoline	+11.75	Swollen	1,430	508	G
Benzene	— 0.86	No change	1,464	429	E
Xylene	— 0.70	No change	1,623	479	E
Lubricating oil	+ 7.54	Swollen slightly	954	167	F
Carbon tetrachloride	+22.35	Swollen	1,560	475	E
Ethylene dichloride	+ 0.80	No change	1,526	300	E
Trichlorobenzene	+26.33	Swollen	1,450	442	G
Aqueous Solutions of Salts					
Na bisulphite, 10%	+ 0.17	No change	1,310	483	E
Ca chloride, 15%	+ 0.70	No change	1,380	483	E
Ca hypochlorite (bleaching soln.)	+ 0.06	No change	1,330	375	E
Duponol ME (fatty alcohol sulphate), 10%	+ 0.04	No change	1,225	463	G
Ferric sulphate, 15%	+ 0.02	No change	1,307	467	E

Key: E = excellent; G = good; F = fair.

POLYTHENE

Polythene (polyethylene) will be used for its good resistance to chemicals, as shown in Table III. Additional information, including physical properties, was recently published.[8] Polythene is perhaps the lightest of all plastics; its specific gravity is 0.92-0.93. Films of polythene can be "heat-sealed" with a hot iron.

Polythene can be applied by the flame-spraying (powder-pistol) process and the films have good chemical resistance and physical properties. A chromium plating tank has been lined with flame-sprayed polythene.

Other applications are as follows: tubing for a DDT process solution, gaskets for lines handling nitric acid in explosives plants, acid buckets and funnels, battery parts, bottles for hydrofluoric acid, and protective coatings and linings.

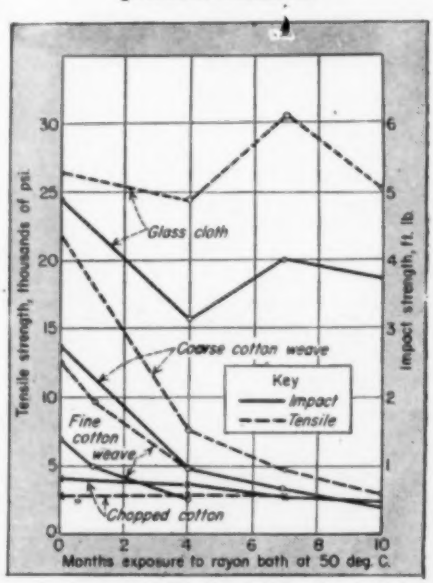
HAVEG

Haveg is a phenolic-asbestos composition. It is discussed here in a separate section because its chief use is in chemical plant construction and because its properties differ from other phenolics. Haveg equipment is produced in comparatively inexpensive molds; high molding pressures are not required.

Haveg is produced in four grades: 41, 43, 50, and 60. Haveg 41 is the "general purpose" material and most widely used; 43 contains a graphite filler and its chief use concerns hydrofluoric acid and related materials; 50 is used primarily for handling strong alkalis; 60 is a new material which

(*Continued on page 109*)

Fig. 2—Effect of exposure to acid on tensile and impact strengths of phenolic laminates



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Characteristics of Commercial Types of DUST COLLECTOR

In two previous articles (February and March) Mr. Hermann talked about hood design and ductwork. In the over-all picture of dust control that brings us to the point where we have a pipeful of dust-laden gas. The question now is how to dispose of it and in most cases that is the same as asking how to get the dust out of the gas. So here is No. III in our series; it is a critical survey of the various kinds of dust collector.—*Editors*

Sometimes it is all right to discharge dust-laden air directly to the atmosphere, but usually there are good reasons for taking the dust out first. Frequently, the dust has cash value and is worth salvaging. In most congested areas it is illegal to spray dust over the neighborhood. Much of the dust discharged outside the building eventually finds its way back and that complicates your own air conditioning problem. There may be other reasons for dust collection but these will do; we are primarily interested in the operating characteristics of the different kinds of device used for the purpose.

SIMPLE SETTLING CHAMBER

The ordinary gravity settling chamber is practical only for removing coarse particles of 50 microns or larger. The removal of small particles is possible if the length of the chamber is increased to 10 or 12 times the height. This is reasonable if you consider the terminal velocity of the smallest particles to be removed and the retention period of the air in the chamber. Particles of 10 microns may be separated if certain conditions are met: Elimination of turbulence, streamline flow, uniform distribution of all inlet air over the entire cross sectional area of the inlet, velocity through the chamber of about 60 ft. per min., and a height-to-length ratio of

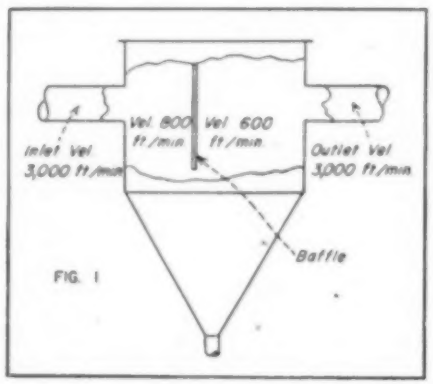


Fig. 1—Gravity settling chamber

0.01. However, a chamber with an h/l ratio of 0.01 would be too large to be practical in the average plant, so some other device is always used to remove the small particles.

Fig. 1 shows a favored design of rectangular settling chamber in which the h/l ratio is rarely less than unity and is frequently greater. The baffle plate in this design is a

Fig. 3—Small-diameter cyclone (Western Precipitation Co.)

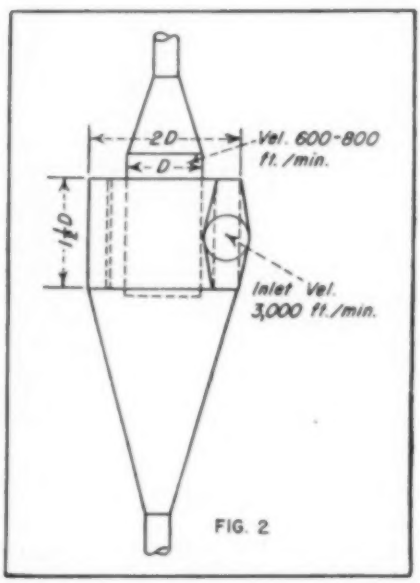


Fig. 2—Large-diameter cyclone

definite departure from theory, but it permits higher inlet velocity and that results in a smaller chamber. Turbulence within the chamber and particularly around the edge of the baffle plate makes it impossible to remove particles of less than approximately 50 microns.

The settling chamber is frequently used as preliminary treatment to reduce the burden on a more efficient device.

CENTRIFUGAL DEVICES

There is a large family of dust collectors which, in one form or another, is found almost everywhere in industry. There are many variations of the principle, but they all have one thing in common: Centrifugal force is the real agent of separation. Some machines have a built-in impeller and some do not; some are wet and some dry. The use of an impeller has several advantages: It acts as a fan to move air through the system; it accelerates the particles and thus increases the centrifugal force; it removes the finer particles by impingement against the advancing surfaces of the impeller

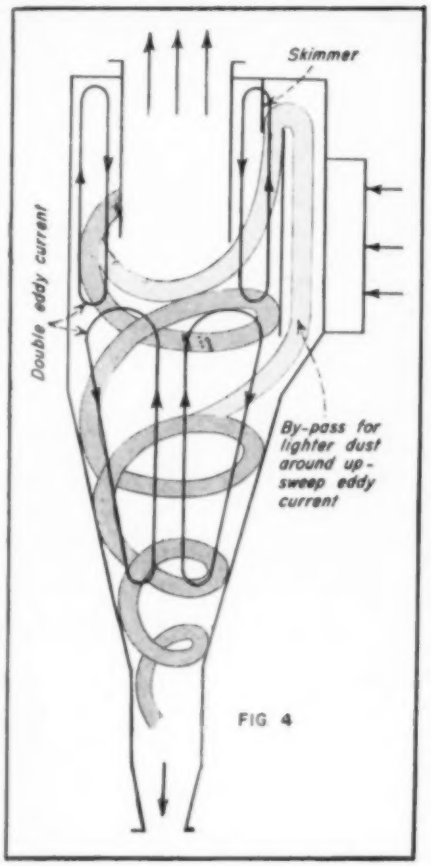


Fig. 4—Van Tongeren cyclone (Buell Engineering Co.)

Fig. 5—Dry centrifugal collector with impeller (Amer. Blower Co.)

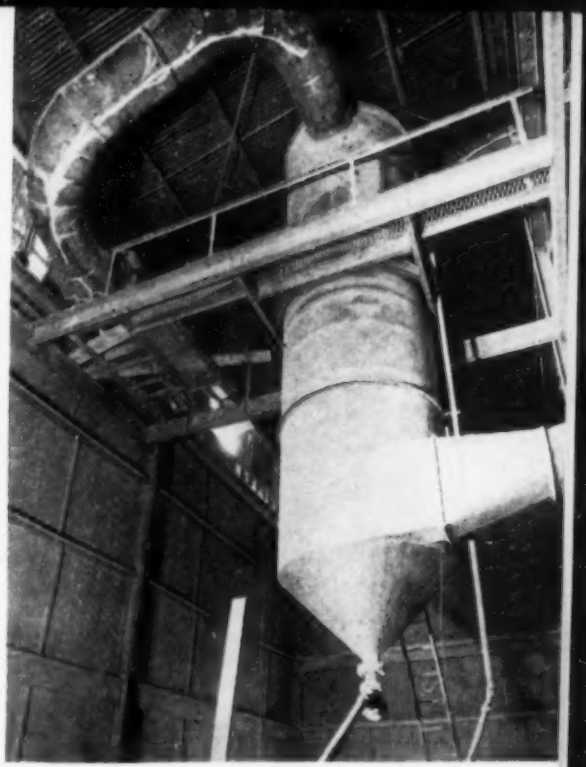


Fig. 6—Wet centrifugal collector without impeller (Schneible Co.)

blades. However, the impeller has the disadvantage of any moving part; it requires power and maintenance. The use of water also has its pros and cons. It wets the dust particles, thereby increasing their mass and extending the range of collection to finer particles; it wets all collecting surfaces with a flowing film of water, thereby minimizing abrasion and capturing permanently all particles that strike the collecting surface. The principal disadvantages are corrosion and the tendency of some materials to become pasty.

Dry Centrifugals, Without Impellers—The basic device in this class is the ordinary large-diameter cyclone (Fig. 2). The cyclone was originally designed for use in woodworking and pattern shops for the collection of shavings and sawdust. It has since spread far and wide and is now one of the most commonly used collectors. The unmodified cyclone is not capable of separating out the very fine dust because of turbulence, especially along the surface at the periphery of the rotating air column. However, there are several modifications of the cyclone which improve its efficiency.

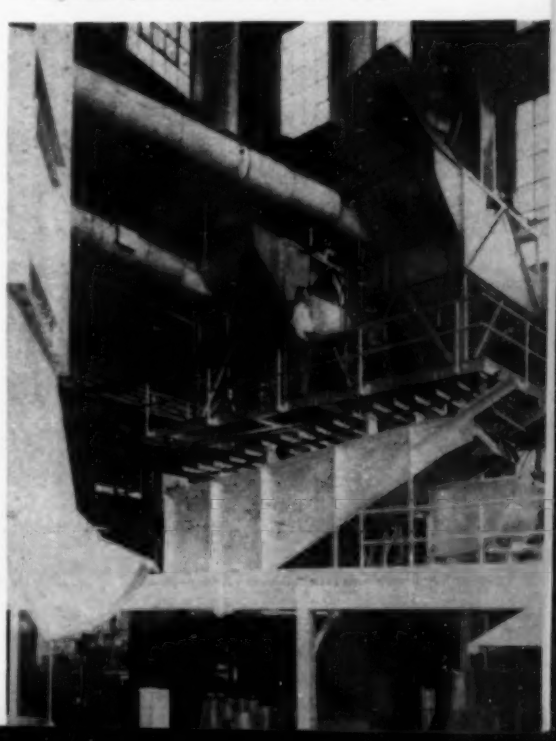
The first is the small-diameter cyclone like the Multiclone in Fig. 3. A nest of small-diameter chambers has two important advantages over a single large-diameter chamber. The particles reach a higher angular velocity, thereby increasing the centrifugal force; there is a larger area of collecting surface and the particles are forced to move through a much shorter distance to reach it. A second modification is the van Tongeren cyclone (Fig. 4); it is designed to negate the disadvantage of secondary, double eddy currents which are present in any whirling body of gas. In an ordinary cyclone the upper eddy carries the lighter particles upward where they accumulate and tend to enter the clean-air stream. The van Tongeren design provides an escape for these light particles and by-passes them down around the upper eddy and into the lower eddy, which is sweeping the walls downward.

There have been other modifications. In one, the shell rotates at the same velocity as the gas so that particles thrown to the surface by centrifugal force will drop down into the lower chamber. In another there is an inner wall with slots in it; particles of dust pass through the slots into a zone of relative quiescence.

Dry Centrifugals, With Impellers—Fig. 5 shows a prominent collector of this type. It also has a secondary unit, a non-dynamic centrifugal collector. Dust-laden air is drawn through the dynamic separator by an exhaust fan having its inlet connected to the central outlet "a." The wheel operates in reverse direction from that of a regular fan; it drives the dust-laden air outward but at the same time a suction is being drawn at the center by the auxiliary fan. Thus the solids are skimmed at "b" while the main body of air passes out through "a" to the exhaust fan. The solids with some air pass into the centrifugal settling-device at "c" where the dust moves downward and the clean air passes upward through the pipe and into the center of the dynamic unit where it joins the main stream of clean air.

Wet Centrifugal, Without Impeller—This type collector is illustrated in Fig. 6. Air is pulled through the unit from bottom to top by an auxiliary exhaust fan. The inlet extends into the shell to about half the diameter and is located tangential to the shell. The bottom of the unit is essentially a wet-wall cyclone above which are located impingement elements and baffle plates which cause the air to take a tortuous path upward through the body of the unit to the exhaust point. Water is directed downward onto the curved baffle plate of the top element; it flows evenly over the plate and downward in front of the apertures of the impingement element to the shelf plate of the element. This shelf directs the water

Fig. 7—Wet centrifugal collector with impeller (American Air Filter Co.)



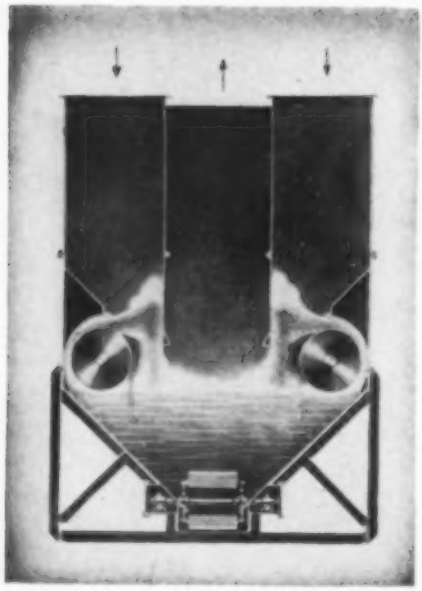


Fig. 8—Washer (Schnieg Industries)

inward and onto the baffle plate of the succeeding element. The water so progresses down through the unit to the drain in the bottom. An entrained-liquid remover is located above the water inlet. Dust particles are removed by impingement on the wet surfaces and are then washed downward and out the bottom to a settling tank; the water is used over and over again.

Wet Centrifugal, With Impeller—The collector shown in Fig. 7 has built into it a wet-wall centrifugal precleaner which removes the bulk of the dust before the air is directed up and into the blades of an impeller. A water jet is located in the center of the air inlet; it sprays a cone of water against the impeller blades. No attempt is made to wet the dust particles in the air stream; instead, they are trapped by impingement against the moving film of water on the collecting surfaces and discharged to a secondary sludge circuit while the cleaned air leaves the forward portions of the blades to the scroll section of the housing. This arrangement, that is, with wet precleaner and wet impeller, was developed to handle heavy concentrations of dust having a wide range of particle sizes. Also, in common with most wet collectors, its performance is not affected by humidity or the presence of steam or fumes in the exhaust air.

WASHERS

Fig. 8 illustrates a different type of collector in which the air is washed free of dust particles. In this equipment the dusty air is drawn through the outer chambers down through the liquid sheet and up through the central chamber into the suction side of an exhaust fan. The liquid, almost always water, is picked up by the rotating drums and is discharged with considerable force from their periphery. The sheet of water strikes the division walls and breaks up into a mist which assists materially in wetting the dust. The air must pass through the sheet and the mist in its course through the machine. Collected solids are removed by a continuous scraper conveyor in the bottom trough of the unit.

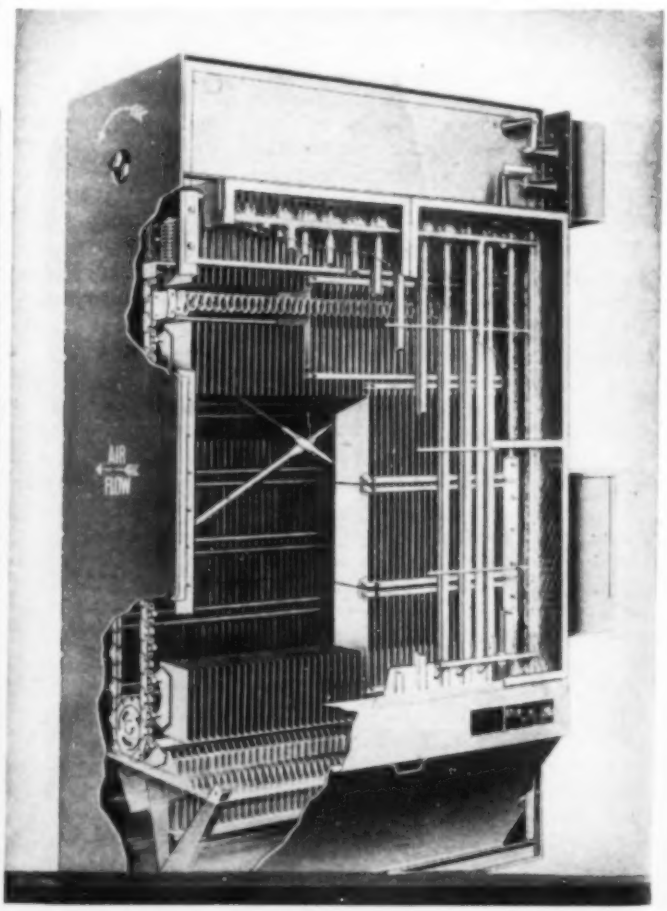
FILTERS

Filters are probably better known than any other type of dust collector. There are two general types: One handles heavy dust loads and requires from ¼ to ½ sq.ft. of filter area per cu.ft. of air; the other is designed for air conditioning where the dust load is extremely light and the air velocity through the filter may vary from 50 to 300 ft. per min. This discussion is concerned only with the heavy duty type.

Fig. 9 illustrates the internal construction of the cloth filter. Dusty air enters the inlet expansion chamber and passes up into the filter tubes from below. The bottoms of the filter tubes are secured to the cell plate and the tops to shaker members by special suspension hooks. The shaker is driven by

Fig. 9, Below—Cloth Filter (Amer. Foundry Equipment Co.)

Fig. 10—Electrostatic precipitator (Amer. Air Filter Co.)



an electric motor and is used to clear the tubes of accumulated dust; inlet air must be shut off when the tubes are being shaken. Air is pulled through the collector by an exhaust fan. Dust is removed from the hopper through a special valve in the bottom of the unit.

A perfect seal must be maintained between the dust side and the clean air side so that all the air goes through the filters. Starting with a clean filter the resistance of the unit is low, about 1 in. water gage. As the dust builds up on the surface of the filter tubes the resistance increases; the frequency of shaker operation depends upon the dust load of the incoming air. In general this type of collector can handle an unlimited dust loading if frequent shutdown for cleaning is not objectionable. From a practical viewpoint a dust load exceeding 10 to 15 gr. per cu.ft. of air would dictate the installation of a continuous type of filter collector. Such a unit is made up of two or more complete cells connected in parallel; one collects while the other shakes. Filter resistance of 5 to 6 in. water gage should not be exceeded for satisfactory operation and low maintenance.

The cloth used is either heavy cotton (about 10 oz. per sq.yd.), wool, or asbestos fabric. Cotton will stand temperatures up to about 180 deg. F. and wool up to 220 deg. F.; for higher temperatures asbestos is required. Where extremely high dust loadings are encountered, pre-separators should be used; this is usually some type of settling chamber. Where high temperature is accompanied by sparking, a spark arrester should be installed ahead of the collector; this is a fine-wire screen in the inlet pipe. Spark arresters must be cleaned periodically because the screen will become clogged with lint; these linters have been known to ignite and carry fire into the collector itself.

ELECTROSTATIC PRECIPITATORS

Electrostatic collectors operate by giving the suspended solids or mists a negative charge; the particles are then attracted to and precipitated on the positive electrode. The air stream passes between the electrodes. One type of apparatus for accomplishing this is shown in Fig. 10. The negative electrode is considerably smaller than the positive. The limitation of the device lies in the available surface of the electrodes and the capacity of the field. Usually electrostatic precipitators are recommended only for light dust or mist loading; for heavy loads it is best preceded by a dry collector or settling device in which the heavier dust is removed.

EXHAUST FAN AND DRIVE

Air flow through the dust control system is maintained by an exhaust fan. The prime mover is usually, but not always, an electric motor. Because most dusts are abrasive the fan should be of sufficiently heavy construction to withstand more than normal wear; at the same time, the weight must be kept within reason for the sake of efficient operation. The location of the fan in the system, the temperature of the gas, and the chemical constituents of the solids will dictate the type of fan and the materials of construction.

If the fan is located on the dust side of the collector, which should only rarely be the case, a heavy, slow-wheel fan should be used. It may have straight or curved blades but straight blades are preferred. For a fan located on the clean side of the collector the more efficient "High Static" fan will be more economical. The usual upper limit of temperature for the steel plate exhauster is about 250 deg. F. for plain and antifriction bearings and about 500 deg. F. for water-cooled types.

The exhaust fan may be located at any convenient point but it ought to be at some distance from the collector to accommodate slow turns and straight runs in the intervening ductwork. The fan inlet should always be a length of straight pipe—never an elbow; eddy currents reduce the capacity of the fan considerably. In cases where space necessitates the use of an elbow at the inlet, splitters should be put in the elbow (Fig. 11). Splitters straighten out the air and insure a more nearly even flow over the entire inlet area. It is advisable to use a square or rectangular elbow since it is very difficult to install splitters in a round ell.

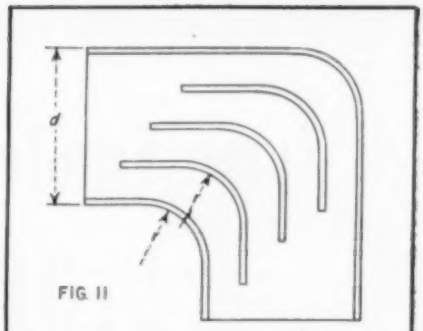


FIG. 11

Table to determine number of splitters and radius r

d, In	Number of Splitters	r, In.
10	4	6
20	5	5½
30	6	5¼
40	7	5
50	8	4¾
60	9	4½

Fig. 11—Elbow with splitters

Direct connection of the driving motor to the exhaust fan is not advisable in view of the necessity for adjusting the speed of the fan. Belt drives are better because of their greater flexibility and the preferred arrangement is to have the motor on the discharge side of the fan scroll; that places the tight strands of the belt on the bottom of the drive.

RUBBER & PLASTICS

(*Continued from page 105*)

may replace the 50 grade. Haveg 60 is claimed to possess a good combination of acid and alkali resistance. None of the Havegs are recommended for nitric acid service.

STYRENES

The polystyrenes show good resistance to acids, alkalis, and some solvents. Two of their outstanding properties are low water absorption and high dimensional stability. Polydichlorostyrene, one of the more recently developed materials, shows better moisture resistance than polystyrene and a heat distortion point of 245 deg. F.

Polystyrene is used for C. P. acid bottle closures, plating tank racks, battery boxes and jars, acid sprays, rotameter tubes, sight tubes, and sight glasses.

ACRYLICS

Wartime demands for transparent methacrylate resins have restricted their development as materials of construction. Methyl methacrylate[4,13] shows good resistance to acids and alkalis except for oxidizing acids such as nitric. This plastic is available as sheet, rod, tubing, solutions, and molded parts. A recently developed "boilable" grade of methyl methacrylate does not soften or distort when exposed to 212 deg. F.

Several applications for methyl methacrylate are as follows: screws, splash guards and enclosures on rayon spinning machines, pump parts (for example, metering pump parts for handling water-treating solutions), sight glasses (for example, sight glasses in contact with mixtures of hydrochloric and hydrofluoric acids), dialysis equipment, and protective coatings.

SILICONES

A new family of plastics, the silicones, became available recently but because of wartime restrictions little experience has been gained in chemical plants. The silicones are used for insulating wire, sheet insulation, impregnating fabrics, lubricants, and for parts requiring "rubber-like" properties. The lubricants show little change in viscosity over substantial temperature ranges.

A silicone has been used for approximately one year in our plants as a lubricant for plug cocks handling 50 percent caustic and 93 percent sulphuric acid; it performed better than previous greases.

I. S. BRUMAGIM *Struthers Wells Corp., Warren, Pa.*

Some Fundamental Factors in Choice of LIQUID AGITATORS

Choice of suitable equipment for the solution of various kinds of mixing and agitating problems is much less complex, the author shows, than has been generally considered. Taking the propeller, shrouded turbine, open impeller and the newer radial propeller, the author discusses the principal characteristics of each and shows how these may be combined with the characteristics of different types of vessel to produce effective combinations of ingredients over a wide range.—*Editors*

So many combinations of conditions must be met in the design of liquid agitating equipment that uncertainty and confusion often exist, both on the part of the designer and the user. This confusion has been multiplied by the numerous theories and formulas which have been published, supposedly to provide for every condition. Generally these expressions involve constants depending on experimental data, which make them worthless except on rare occasions.

In fact, the whole subject seems to be needlessly surrounded with mystery and confusion. This is particularly true with regard to the so-called high speed liquid agitators, the turbine and propeller.

While it will probably always be necessary to resort to experiment to ascertain how to meet the more unusual conditions, adequate data are actually available for the purposes of ordinary agitator design, providing a few simple fundamentals are borne in mind.

Use of propellers or turbines for agitating liquids involves two separate and distinct problems: (1) The circulation of the mass, and (2) the physical change imparted to the component parts of the mass by the agitator. This article will deal with the essential phases of these two problems, first from the standpoint of circulation (the "hydraulics of agitation") and second, from the standpoint of physical change (the "mechanics of agitation").

THE PROPELLER

Prime requisite to the use of propellers or turbines as agitators is the circulation of the mass to and from the agitator. Since the propeller presents the greater complication, it will be dealt with first. The propeller is in reality a section of a screw and imparts movement to a stream of liquid of a diameter approximately that of the propeller. This stream flows forward and outward, falls back around itself and is recirculated into the propeller, a combination of movements illustrated in Fig. 1.

In this sketch lines *A*, *B*, *C*, *D*, and *E* indicate the movement of the liquid through a cross-section of the area at the propeller which derives its motion directly from the propeller. We will consider this area as the zone of primary flow. This zone actually takes the shape of a large doughnut with the propeller located at the center. The outer periphery of the stream, indicated as Line *E*, turns back quickly in a circle of a small radius and re-enters the propeller. The center of the stream at Line *A* flows forward a greater distance and finally turns back on a circle of relatively larger radius. Immediately adjacent to the propeller the streams of liquid in Lines *A* to *E* move with approximately the same velocity. These velocities decrease, however, in proportion to the distance any particle of liquid is removed from the propeller, with the result that the part of the liquid moving along Line *E* maintains a much greater velocity than that which follows Line *A*. That portion of the liquid that follows Line *A* through one cycle is then dissipated at the propeller and is thrown out along one of the infinitely great number of available lines, all of which move at different velocities. This results, then, in a continuous change of position of each particle and all the other particles in the primary zone, which constitutes good mixing.

The condition illustrated in Fig. 1 could exist only where the agitator is mounted in a vessel of such large size that the primary zone is not restricted or in any way affected by the walls of the container. The liquid surrounding the primary zone, however, does retard the flow of moving liquid along the outer periphery of the primary zone, thereby being set in motion in a direction reverse to that of the primary zone. These areas will be considered as zones of secondary motion or secondary zones. In gasoline or liquids of extremely low viscosities, the areas of secondary motion extend through great distances and satisfactory blending is thereby obtained.

However, the majority of agitating problems involve liquids of greater viscosity, in which the secondary motion is quickly dissipated, resulting in areas in which there is little or no blending. Hence it has been necessary to devise ways of extending the primary zone to the entire mass to be blended. In some cases this has been accomplished simply by making the vessel of a size and shape which will just contain the area of primary flow.

Fig. 2 shows the ideal design of a tank for use with a propeller mounted on a vertical shaft. In order to contain the flow emanating from the propeller it is necessary to provide an inverted cone extending downward to a junction with a specially curved head which follows the natural path of the liquid as it reverses direction upward along the walls of the vessel. The upper surface need not be contained, but the depth must not be so great that the upward movement is dissipated before it reaches the surface. Naturally, the cost of fabrication makes this vessel impractical.

A substitute design incorporating a conventional bottom head as shown in Fig. 3 is often used. This method is effective only in low-viscosity liquids where there is no great variation of specific gravity between the elements to be blended. The cone shaped secondary zone below the agitator provides a dead pocket for the accumulation of the heavier elements, resulting in incomplete blending.

A much more effective method is to locate the propeller on a horizontal shaft near the bottom of a vertical cylindrical vessel, with the shaft a few inches off the center line of the vessel. The flow from the propeller is thereby directed in two directions,

first in a whirling motion around the vessel, and second, in an over-turning motion across, up and back over to the propeller. The whirling motion naturally extends upward to the surface of the liquid and amplifies the distance to which the over-turning motion is carried. In this manner the area of primary flow can be more than doubled. The plan and elevation shown in Fig. 4 indicate the whirling and over-turning components of flow created by such a propeller.

Direct impingement against a right angular surface is eliminated in the last described method, thereby preventing a considerable loss of velocity. The whirling component does not give much blending or recirculation to the propeller, except in that level of the liquid adjacent to the propeller. It is, therefore, necessary to locate the propeller at the proper distance from the center line so that the whirling motion will not be so excessive that the over-turning component will be lost. The best results are obtained when only sufficient whirling is created to extend the over-turning motion to the surface of the liquid. It is this over-turning motion, with its wide variation in component velocities, that is the major source of intermingling within the mass.

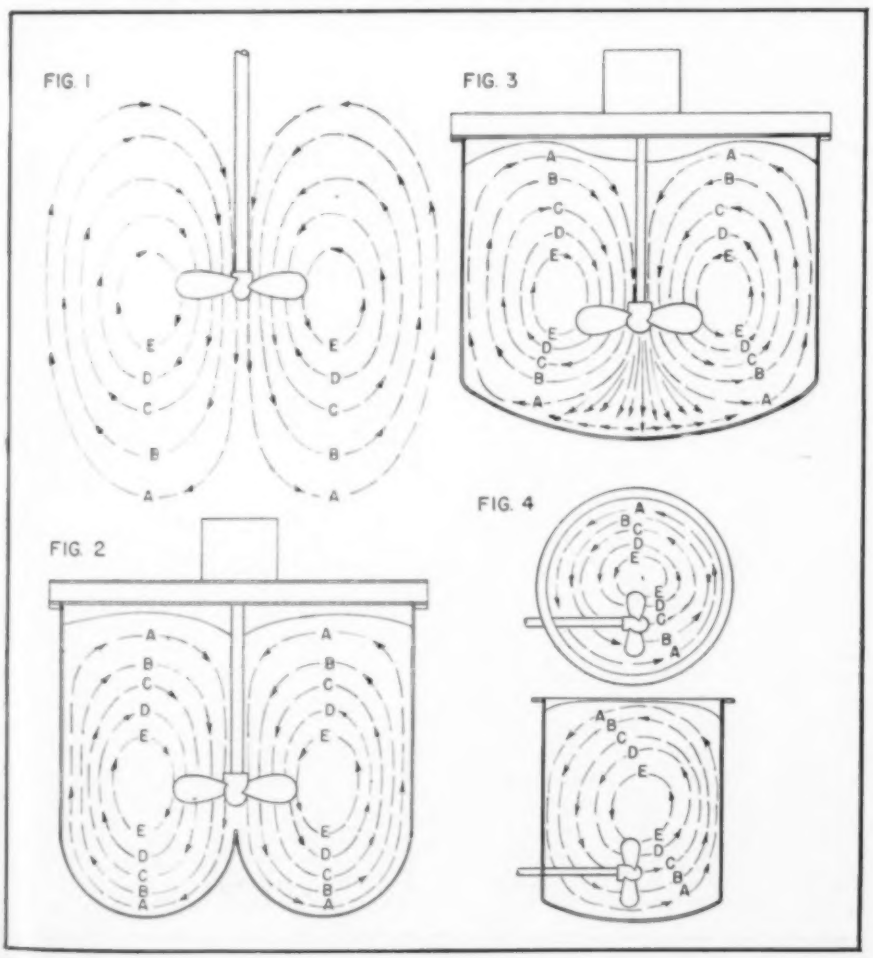
Fig. 5—For intense agitation of extremely viscous mixtures such as rubber cement this double-propeller design is used

A highly efficient arrangement is that used in the Struthers Wells rubber cement mixer shown in Fig. 5. The flow of the mass is indicated in Fig. 6. Here the bottom agitator is mounted to direct the flow on a line tangent to the hemisphere which forms the bottom head. This flow follows the curve of the vessel upward and enters into the zone of agitation of the upper agitator which is mounted in the top hemisphere of the vessel. The upper agitator then forces the liquid back into the lower agitator. This combination gives a high degree of streamlining to the liquid motion and decreases the distance to which the liquid must be thrust in order to be within the range of primary motion. If the size of the agitator and vessel are properly proportioned and sufficient power is provided, masses of unbelievable viscosities can be thoroughly and efficiently agitated in this mixer.

The cost of this equipment, however, restricts its use to agitation problems of the most severe nature.

There are other methods in which the primary flow set up by a propeller may be made to reach the farthest corners of the container. All of these methods, however, employ the three general plans noted above, using some variation or combination of the three.

Figs. 1 to 4—These sketches illustrate the flow lines produced by a propeller under various circumstances. Design is influenced largely by viscosity and vessel size



PROPELLER APPLICATION

Before discussing the turbine it may be well to review the range of application to which propeller agitators lend themselves.

Propellers may be used in liquids of lower viscosities without restriction as to the size and shape of the vessel—within reasonable limits. In viscosities ranging roughly from 500 to 5,000 centipoises, a propeller mounted on a vertical shaft may be used successfully in vessels ranging in volume up to roughly 1,000 gal., especially if the agitator is mounted off the center line of the vessel. The propeller is not generally considered a good agitator for liquids of viscosities over 5,000 centipoises, although when located within a properly streamlined vessel, with sufficient power provided, it can be used efficiently in extremely viscous liquids. Where mechanical cutting and shearing of a viscous material is required, as in rubber cement mixers, the excellent shearing characteristics of the propeller can be exploited by providing vessels that are exceptionally well streamlined.

THE TURBINE

Circulation created by a turbine differs materially from that of the propeller. The areas of unrestricted flow shown in Figs. 1 and 7 illustrate how the two streams differ. Fig. 7 indicates the flow that is typical of any of the various agitators classified as turbines, namely the shrouded turbine, the open impeller, the straight bladed turbine, with the blade at 45 deg. from vertical, and the radial propeller agitator of Struthers Wells.

First of the major differences between the streams emanating from the propeller and the turbine lies in the fact that a right-

angular change of direction occurs in the turbine, while the stream goes straight through a propeller. This is a distinct advantage in the effectiveness of the turbine and will be analyzed further.

The second major difference is due to the fact that the flow from a propeller is a cylindrical stream parallel to the propeller shaft, while the flow from a turbine proceeds radially outward in a complete circle prependicular to the shaft. The natural direction of flow is not truly radial but lies between the radius and tangent of the turbine circle. This condition can be extremely advantageous and will also be considered later.

In the turbine the right angular change of direction simplifies the problem of containing the area of primary flow, especially with the use of a single turbine in the bottom of a cylindrical vessel. A single turbine is one which is so designed that as the liquid is thrust outward by the turbine blades it is replaced from one side of the turbine only. The liquid is sucked into the double turbine from either side as in Fig. 7. If the single turbine is mounted on a vertical shaft, near the bottom and on the center line of a cylindrical vessel as shown in Fig. 8, the head and shell of the vessel just nicely contain the primary zone and it is necessary only to proportion the agitator diameter to the vessel diameter correctly to insure effective movement to the contents.

This arrangement has several important advantages. The movement of the mass originates in the lowest part of the container where the heavier components are actually thrust away by the turbine blades. As the zone of greatest velocity is in the circle just adjacent to the turbine, the heavier materials are thrown a maximum distance away from the turbine, where they mingle with the other components to form a homogeneous mass. The right angular change of direction within the turbine gives a natural unobstructed flow down the shaft and radially outward parallel to the bottom head, eliminating impingement of the stream against the head of the vessel, which adds considerably to the area of primary flow.

Furthermore, as the outward thrust is dissipated and tends to turn back toward the turbine, the cylindrical walls of the vessel conform to and direct this movement without serious impingement, providing the agitator and vessel are properly proportioned. The flow along the vessel head and shell is uniform at any point on a given periphery. This movement is analogous to the waves set up by throwing a stone into a pond of water in that the velocity of the wave decreases uniformly as it moves away from its point of origin. This is an important factor in problems of agitation involving heat transfer through the vessel wall.

The natural tendency of the turbine to create a substantial whirling component in the movement of the mass is an important advantage which, however, must be properly controlled. Again emphasis must be placed on the fact that whirling motion does not contribute much to blending or recirculation to the agitator, but is an excellent means of extending movement upward throughout the vessel contents. It is possible therefore, where no physical change of the components to be processed is required, to obtain excellent blending by simply removing or otherwise adjusting the stators or baffles which are used to retard the whirling of the contents. There must, however, be a noticeable over-turning on the surface of the liquid to maintain satisfactory blending.

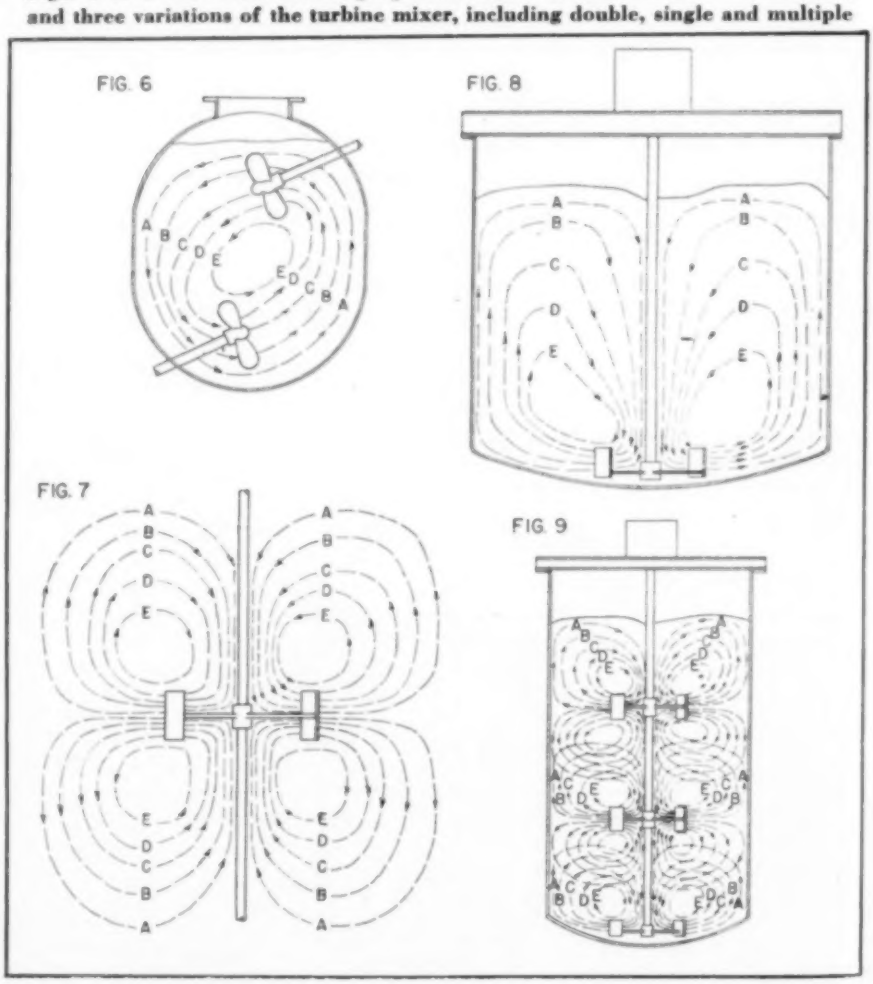
Viscosity has much to do with the distance to which movement of the mass can be extended. As the viscosity increases the whirling component becomes more essential and in agitating liquids of high viscosity baffles and stators are usually eliminated. This is possible because the friction within the mass is sufficient to eliminate excessive whirling, the whirling being necessary as a vehicle for over-turning. The use of baffles adjustable from the outside of the vessel is often advisable where viscosities vary throughout the process.

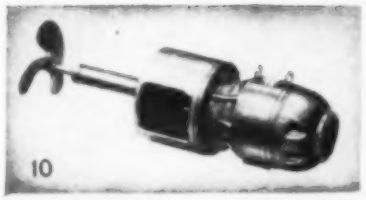
Although the area of primary movement may be greatly amplified by releasing the whirling component from the turbine, in so doing much of the turbulence at the agitator is sacrificed. In many cases this makes it necessary to find other means of solving this problem and still maintaining turbulent or violent agitation.

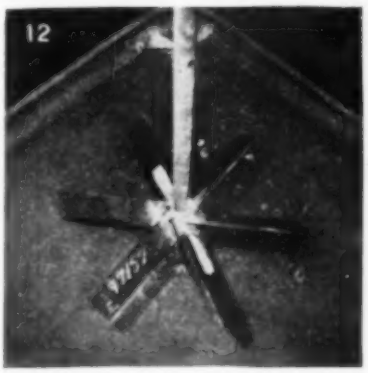
As it is necessary in maintaining maximum turbulence to eliminate all possible whirling, the extent of the primary zone can reach only as far as a maximum allowable original velocity will thrust the liquid in a simple over-turning movement. The extent of the initial primary zone being thus limited, a second primary zone may be created above the first by simply adding another turbine on the common shaft a few feet above the first. If the turbines are properly spaced to provide ample intermingling along the plane of contact between the zones, violent agitation and excellent blending can be thus provided in large volumes of liquids. Fig. 9 illustrates this application. Here a single turbine is mounted in the vessel bottom, in combination with double turbines mounted higher in the vessel on the same shaft.

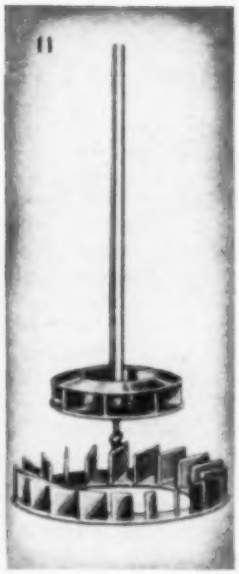
Right angular changes of direction in the turbines contribute much to the success of this arrangement. By mounting several agitators on a common shaft, the cost of the

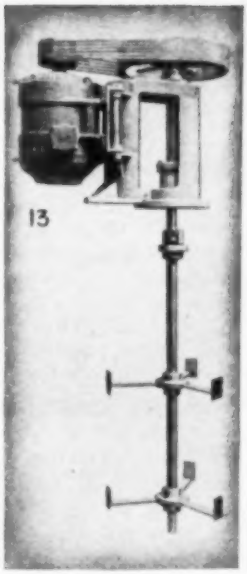
Figs. 6 to 9—How the double-propeller rubber cement mixer is constructed; and three variations of the turbine mixer, including double, single and multiple











Figs. 10 to 13—Four fundamental agitating devices including (10) the propeller; (11) the shrouded turbine; (12) the open impeller; and (13) the radial propeller

drive and agitator supporting equipment is made much more favorable.

Another phase pertaining to liquid circulation, which becomes important with viscosity increase, is the ratio of volume to velocity. The curve of power vs. increasing velocity for viscous masses moves upward at a sharp angle. This can easily be demonstrated by moving a paddle through a viscous liquid, first slowly, and then rapidly. It is possible to move a large volume of viscous liquid at low speed, thereby overturning a contained mass with much less power than is required to impart sufficient velocity to a smaller volume to over-turn an equal mass. This phenomenon is important in the design of agitating equipment for the simple blending of viscous liquids.

The range of application to which a turbine lends itself is identical with that of the propeller. Both are limited by the possibility of recirculation into and away from the point of applied agitation. However, the turbine can be used with less complication of vessel design, especially in more viscous liquids. Also, the turbine can invariably be mounted on a vertical shaft, which permits the shaft stuffing box or seal to be above the liquid level. This is often a real advantage.

MECHANICS OF AGITATION

While good circulation is a "must" in liquid agitation, the physical change imparted to the components of the mass by the action of the agitator itself is also important. This may be thought of as the "mechanics of agitation."

The several general types of high speed liquid agitators, namely; the shrouded turbine, the open impeller, the propeller and the radial propeller are illustrated in Figs. 10 to 13. Each of these agitators differs in the manner in which it imparts movement to the liquid. The propeller (Fig. 10) cuts sharply through the liquid and pushes it forward by propulsion. The shrouded turbine (Fig. 11) is a simple centrifugal pump without a housing. It imparts motion by centrifugal force rather than propulsion, its blades sweeping by the liquid without actually cutting through. The shrouds simply direct the flow and confine it to the blade area. The open impeller (Fig. 12) does exactly the same work as the shrouded turbine, the only difference being in the fact that the flow is not directed by shrouds to the blade area. Both the turbine and the impeller have a great tendency to whirl the contents.

The radial propeller (Fig. 13) creates a flow similar to that of a turbine but when designed with its blade pitch comparable to that of a propeller, the blade actually cuts through the liquid in the same manner as the propeller and actuates the liquid by propulsion rather than centrifugal force. As the pitch is increased beyond ordinary propeller pitches and approaches the angle of the turbine blade, the radial propeller also acts in the manner of a centrifugal pump.

The shrouded turbine and the impeller provide good turbulence and create excellent blending. Shearing action does not become an important factor, however, until the peripheral speed becomes so high as to cause cavitation. The speed necessary to bring about shearing with the turbine or the impeller, on account of the necessity of forcing the flat side of a blade through the liquid at excessive velocity, requires exorbitant power. This is analogous to attempting to chop wood with the flat side of the ax, rather than the edge of the blade.

Cutting-through action of the propeller and the radial propeller makes it possible to obtain excellent shearing and destructive effect by actual impact of the agitator blade. This is important in the dispersion and the dissolving of solids, particularly where the solids are in sizable lumps. This is well demonstrated by the use of the propeller for the processing of rubber cement. The same advantage is available in the dispersing of gases in liquids, since dispersion can be obtained by the mechanical action of the blade rather than partial cavitation of the liquid which is necessary to accomplish the same result with the turbine.

Power required to obtain destructive action with these devices, by cutting through the liquid and shattering the solid lumps or gas pockets, is much less than is necessary in sweeping a turbine blade through the liquid at sufficient speed to break the liquid down and cause cavitation. It is doubtful if comparable results can be obtained even at maximum speed of the turbine, as complete cavitation would result before an equal destructive action could be obtained.

In deciding what type of agitator is best for the many combinations of conditions that pertain to a particular process, it is necessary to analyze the problem first from the standpoint of adequate circulation and, second, with regard to the most economical means of providing the physical changes necessary to the process. In considering these phases it is also well to give thought to ease of operation and maintenance of the equipment.

Stated in other words, those characteristics peculiar to the several common types of agitators should be studied and that agitator selected which provides the greatest number of functions favorable to the particular problem. Some of these characteristics are tabulated below.

The propeller is:

1. Self cleaning in operation.
2. Operated at a wide range of speeds commensurate with pitch.
3. Pitched at a wide range of angles commensurate with speed.
4. An excellent shearing device at high speed.
5. Non-destructive at low speed.
6. Economical in power consumption through its full range of speed, provided pitch is proportionate to the speed.
7. More difficult to locate in the container than other types in giving a circulation which can be amplified and contained.
8. Often mounted on a horizontal shaft, necessitating a stuffing box in the liquid.
9. Not effective in viscous liquids without expensive streamlining of the vessel.

The shrouded turbine is:

1. Excellent in providing circulation which is easy to contain and amplify.
2. Normally mounted on a vertical shaft with stuffing box (if one is needed) above the liquid.
3. Effective in high viscosities without

the necessity of expensive streamlining of vessels.
4. Easily fouled or plugged by solid particles.
5. Somewhat expensive to fabricate.
6. Restricted to a narrow range of speeds.
7. Non-destructive at economical speeds.
8. Limited in area of input flow.

The open impeller is:

1. Somewhat more self cleaning than the shrouded turbine although it has inaccessible pockets around the impeller hubs.
2. Excellent in providing circulation which is easy to contain and amplify.
3. Ordinarily mounted on a vertical shaft with stuffing box (if one is needed) above the liquid.
4. Effective in high viscosities without the necessity of expensive streamlined vessels.
5. Comparatively inexpensive to fabricate.
6. Limited to a narrow range of speeds.
7. Non-destructive at economical speeds.
8. Limited in input area by obstruction of blades emanating from hub.

The radial propeller agitator is:

1. Self cleaning.
2. Excellent in providing circulation which is easy to contain and amplify.
3. Invariably mounted on vertical shaft with stuffing box (if one is needed) above the liquid.
4. Effective in high viscosities without expensive streamlining of vessel.
5. Inexpensive to fabricate.
6. Capable of economic operation at a wide range of speeds commensurate with the blade pitch.
7. Designed in a wide range of blade pitch commensurate with speeds.
8. Excellent in shearing and destructive action at high speeds.
9. Non-destructive at low speed.
10. Economical of power through the full range of speeds providing pitch is proper for the rotational speed.

When the functions best suited to the given problem have been checked off, and the type of agitator to be used has been chosen, there is still the possibility that the viscosity of the liquid may lie in the borderline range where only actual experiment can prove whether the agitator specified is adequate. It may be that circulation of the mass in the volume to be handled may approach or be beyond the capacity of the agitator, in which case experimentation is necessary. Ordinarily, however, the data published in good chemical handbooks, supplemented by that accumulated by the mixing equipment manufacturer, is ample for the solution of the ordinary mixing problem. Such data are being checked continuously and improved and amplified by laboratory, pilot plant and actual industrial plant tests. When used in the accepted formulas of hydraulics and mechanics they serve as a satisfactory basis of liquid agitator design.

Government Surplus Plants to Be Adapted to Private Needs

With the assistance of a special staff the War Assets Corp., successor to RFC in plant disposal, is making a systematic effort to interest prospective buyers or lessees of government-owned surplus chemical plants in adapting the installations to profitable operation by the addition of facilities or alteration of existing equipment. The group engaged in this enterprise is the Plant Utilization Section of the Engineering Division, War Assets Corporation.

It is recognized that many plants will be difficult to sell or lease on terms acceptable to both the buyer and the government by reason of an oversupply of products the plants were designed to manufacture. The alteration of such plants to produce other products for which there is a profitable market is regarded as the logical solution. This is one of the major approaches along which the Plant Utilization Section is working. The section has outlined a group of plants which are being studied with a view to their adaptation to postwar use. Chemicals hitherto produced by this group include caustic and chlorine, nitrogen (atmospheric fixation), peroxygen chemicals, sulphuric acid and oleum, hydrofluoric acid, industrial gases, aviation gasoline, carbon black, synthetic rubber, insecticides and pharmaceuticals.

It is believed that the plants are capable, through technological ingenuity, of an appreciable degree of adaptation. In the event that leases are attractive, rents can be based on units of production, usually with a minimum yearly rent guaranteed. Where alterations are made at lessee expense such expense can be amortized as a credit against rental. Although government operation is not contemplated, the Plant Utilization Section has assembled a staff to aid industry in the study of plant potentialities and the making of necessary changes. In addition, well equipped laboratories and pilot plants of a number of surplus chemical plants are available to prospective buyers or lessees to carry out development work by interim leasing agreements.

An important element in the alteration of plans under this program is the fact that much of the machinery and other equipment from idle plants becomes immediately available for use in plants capable of being converted. To expedite determination of the location and character of the individual equipment work is under way on the cataloging and indexing of the various items. Duplicate cards identifying these by name, Standard Commodity Classification and other descriptive matter are being filed in Washington and at the disposal agency where the property is located. In the event a sale is made in the field, a sale card is sent to Washington to cancel the listing.

Surplus aviation gasoline facilities seem to constitute a promising field for conversion at reasonable cost. Developments in catalytic cracking in recent years have resulted in a type of process capable of yielding a wide variety of hydrocarbons, the proportions of which may be altered by changes in operating conditions. Aromatics and unsaturated hydrocarbons are some of the chemical raw materials that may be produced in large volume by catalytic cracking. Catalytic alkylation is another aviation gasoline process subject to variation of products by selection of different charge stocks and operating variables. The adaptation of these and associated processes to the manufacture of chemicals from petroleum is particularly promising.

The synthetic ammonia plants offer another field worthy of investigation. Some are well located for serving the agricultural market through the conversion of ammonia to fertilizer chemicals such as agricultural solutions, sodium nitrate, ammonium phosphates and ammonium sulphate. Excess sulphuric acid manufacturing capacity, in the South, for instance, could be utilized in combination with ammonia plants to produce ammonium sulphate. Ammonium phosphates could also be manufactured. Morgantown Ordnance Works is equipped to produce methanol, which can be synthesized at 4,500 psi. All ordnance works operate at this pressure except the Morgantown and Missouri works, which are 10,000 psi. plants. The availability of numerous ammonia oxidation units at TNT and smokeless plants enables HNO_3 to be made.

Surplus plants for manufacturing oxygen and acetylene are worth investigating in view of transportation methods that are alternative to movement of the gases in cylinders. The cost to consumers can be materially reduced if the production plant is near the point of usage, as delivery can then often be made by pipeline at low pressure. It has been estimated that in some instances savings of 4 to 6c. per 100 cu.ft. of oxygen are possible through pipeline movement and low-cost electric power. Also, the shipment of liquefied oxygen in 30-ton lots in insulated cars is a recent development which should make oxygen available for chemical and metallurgical operations that were previously impracticable because of high oxygen costs.

Although it is impossible here to cover in detail the numerous types of chemical plants and the new products they may be adapted to manufacture, the principles outlined above underlie that phase of the government's plant utilization program looking to plant conversion. It is regarded as a policy presenting many opportunities to industry.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 CASH-PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the "*Chem. & Met. Plant Notebook.*" The winner each month will be announced in the issue of the next month: e.g., the April winner will be announced in May, and his article published in June. Judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at space rates applying to this department. (Right is reserved, however, to make no award in months when no article received is of award status.)

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

MARCH WINNER!

A $50 Series E Savings Bond will be issued in the name of

A. C. GUILLEN
Engineer
Algiers, North Africa

For an article dealing with a novel idea for a self-cleaning orifice for solids-carrying lines that has been judged the winner of our March contest.

This artice will appear in our May issue. Watch for it!

February Contest Prize Winner

HOW A COMBINED HOIST, CARRIAGE AND TIPPER WAS BUILT FOR ACID CARBOYS

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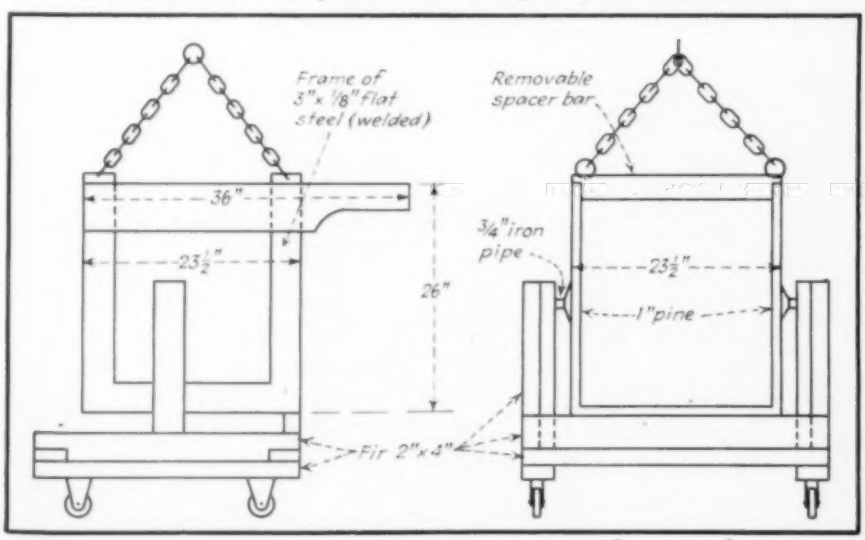
Iowa State College
Ames, Iowa

CONSTRUCTED to simplify carboy handling the device shown in the illustrations has been used effectively in moving carboys of sulphuric acid from the first floor to the second floor of a building where no elevator is available. The boxlike upper part shown in the drawing was constructed of wood and ⅛-in. flat iron of a size such that a carboy of standard size can readily be accommodated. At each side are attached by means of floor flanges 3-in. lengths of ¾-in. iron pipe which act as an axis about which to swing the carboy holder when emptying the carboy. These set down into wooden bearings or sockets in the base section, or carriage. Except when the carboy is being tipped to empty, the upper section of the holder is supported in the pipe bearings and the rear edge of the base. Handles for tipping are built into the upper section. Attached to

Construction of carboy holder and carriage is here clearly shown



These views show how the carboy holder is elevated to the second floor, then lowered into its carriage

steel rings on the upper section are four pieces of steel chain connected at their upper ends to a central steel ring to which may be hooked a hoist for lifting. A wooden spreader piece is inserted between the handles to prevent the frame from collapsing inward when the load is put on the chains. When a carboy is to be put in or out of the holder, this spacer bar is lifted out. Four large casters on the base facilitate moving the holder over the floor.

Operation of the carboy holder is as follows: The upper section of the holder is placed where it can be picked up readily by a chain hoist. A carboy of acid is moved over to it on a two-wheeled warehouse truck and placed on its bottom. The spacer bar is inserted. The hook in the hoist is inserted in the chain ring and the holder and carboy are hoisted to the second floor. The top section of the holder is then lowered into the carriage and the hoist disconnected. The holder with the carboy is now pushed to the position where it is desired to remove acid into smaller containers. The acid is emptied by the handles by merely tipping the upper section containing the carboy.

This device has been used to handle acid in a pilot plant where it has been found both convenient and practical.

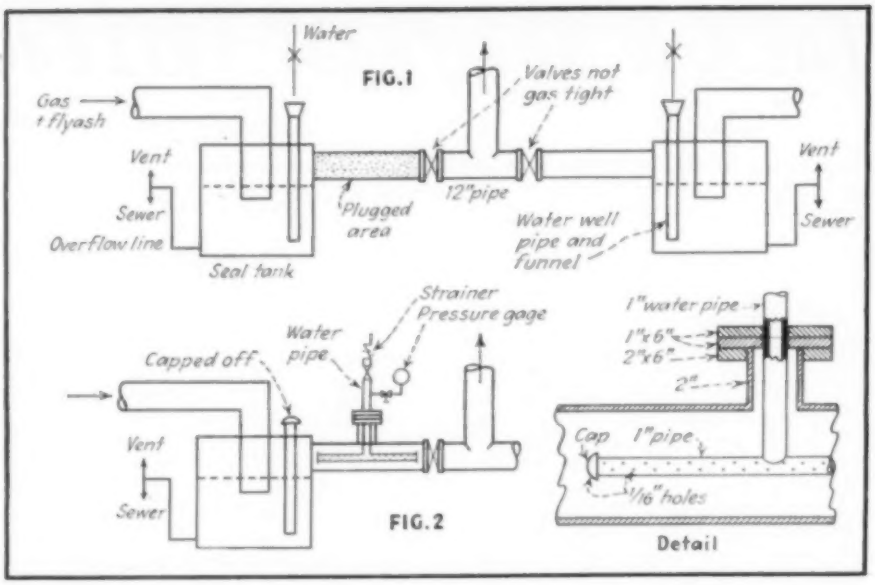


Fig. 1—Here is how the water seal system was arranged originally

Fig. 2—This sketch (and detail) shows how water spray was installed

A CHANGE THAT IMPROVED BOTH MORALE AND PRODUCTION

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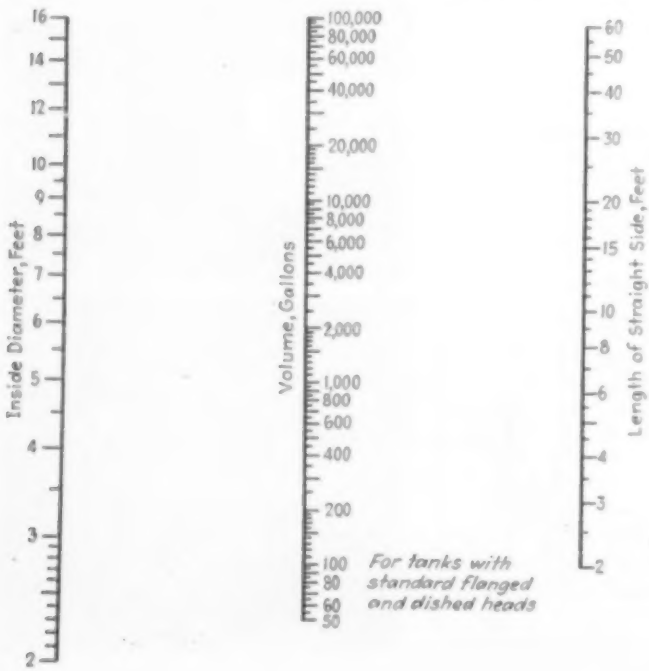
IN A PLANT of which the writer was recently superintendent, gas pumping capacity and consequently production were lowered due to flyash depositing in 12-in. pipelines and eventually plugging them, necessitating frequent shutdowns. Cleaning took much time as the gas was odorless, poisonous and explosive and very adequate safety precautions had to be taken. Needless to say, in such an atmosphere psychological tension was high.

Fig. 1. shows one of the worst spots (the 12-in. exit pipe from the tank would become completely plugged) in the setup before any changes were made. It will be noticed that the seal water was introduced through a line not solid with the tank. A potential hazard of this arrangement was the possibility of air being entrained by the water flowing into the tank and forming an explosive mixture—especially when the washer had been out of service for a while.

Alterations were made to the system as shown in Fig. 2 and the detail. The well pipe in the seal tank was blocked off, and the 12-in. pipe between tank and valve was drilled and tapped for a 2-in. nipple and standard flange. A 1-in. perforated T pipe was inserted in the center of the 12-in. pipe with a 1-in. x 6-in. dutchman, and the water line was then connected to the latter.

The turbulent cutting spray produced was very satisfactory, and four results were obtained: (1) The line was kept clear of flyash averting shutdowns and production losses. (2) Placing the water line in a more strategic spot served not only to scrub the pipe and gas, but also to maintain the seal since the water merely drained from the bottom of the pipe into the seal tank. (3) By making the water line solid to the system, the possibility of air entering and forming an explosive mixture was avoided. (4) Lastly, and perhaps this should be first, psychological tension was eliminated.

As a corollary to the above a system of internal water spray pipes was installed in all such lines to yield smooth and safer operation.



Nomograph for total capacity of cylindrical tanks with standard flanged and dished ends

NOMOGRAPH FOR TOTAL VOLUME OF CYLINDRICAL TANKS

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IT IS OFTEN necessary for the engineer to estimate quickly the total capacities of cylindrical storage tanks. The conventional method consists in first calculating the volume of the cylindrical portion of the tank and then adding to this figure the combined volume of the two heads. Owing to the

Volume Corrections for Heads Other Than Standard Flanged and Dished Type

Inside Diameter, Ft.	Volume Correction, Gal. Flat Head	Shallow Dish Type	A.S.M.E. Type	Elliptical Type
3	− 20	.....	+ 10	+ 30
3.5	− 35	.....	+ 20	+ 50
4	− 50	.....	+ 25	+ 70
5	− 100	.....	+ 55	+ 135
5.5	− 140	− 60	+ 65	+ 180
6	− 180	− 70	+ 85	+ 230
7	− 285	− 85	+140	+ 370
8	− 420	−210	+210	+ 555
9	− 600	−270	+300	+ 790
10	− 825	−480	+410	+1,085
11	−1,100	−600	+550	+1,440
12	−1,430	−725	.....	+1,870

somewhat time-consuming nature of such a procedure, a nomograph has been prepared which enables one to obtain a quick estimate of tank volumes sufficiently accurate for most purposes. To obtain the total volume of a given tank it is simply necessary to connect the diameter and length scales of the nomograph with a straight line. The volume is read at the point of intersection of this line with the volume scale.

The accompanying nomograph solves the following empirical equation:

$$V = 6.5\ L^{0.96}\ D^{2.07}$$

where V = total tank volume, U. S. gallons; L = tank length, straight side, feet; and D = internal diameter, feet.

This equation is applicable to tanks equipped with standard flanged and dished heads. For tanks whose length is from one to five times the internal diameter, the calculated volume may deviate from the true volume by not more than about 3 percent. The equation is not recommended for tanks whose length is less than three-fourths or more than ten times the internal diameter.

For tanks equipped with other than the standard flanged and dished type of head, the volume may be estimated by using the accompanying nomograph and applying a volume correction which is a function of the type of head and the diameter of the tank. Approximate volume corrections are presented in the tabulation.

To illustrate the use of the nomograph and volume correction table, the following examples are given:

Example 1—Estimate the capacity of a tank of outside diameter, 6 ft.; straight side length, 8 ft.; shell thickness; $\frac{1}{4}$ in.; with standard flanged and dished heads.

The internal diameter of the above tank is equal to 6–0.5/12 = 5.96 ft. By connecting 5.96 on the diameter scale with 8 on the length scale, one reads the volume as approximately 1,850 gal. The true volume, based on tank head volume data[1] is calculated as 1,849 gal.

Example 2—What would be the capacity of the above tank if it were equipped with A.S.M.E. heads?

From the tabulation the volume correction for a tank equipped with 6-ft. O. D. A.S.M.E. heads is found to be + 80 gal. The estimated volume is, therefore, equal to 1,850 + 80 = 1,930 gal. The true volume, based on tank head volume data[2] is calculated as 1,934 gal.

REFERENCES

1. Bethlehem Steel Co., "Steel Plates," page 145 (1935).
2. Buffalo Tank Corp., "Handbook, Welded Steel Plate Construction," page 81, First Edition.

LATENT HEAT-TEMPERATURE NOMOGRAPHIC CHART

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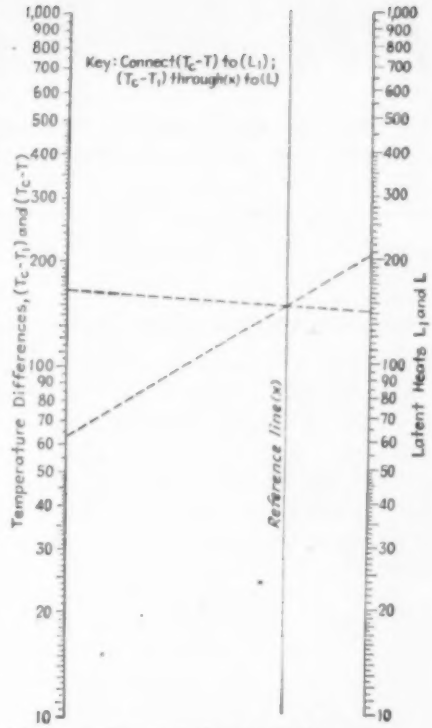
For correlating latent heats and temperatures for any substance, the Watson equation is as follows:

$$\frac{L}{L_1} = \left(\frac{1 - T_r}{1 - T_{r1}}\right)^{0.38}$$



Nomograph correlating latent heats and temperatures for any substance

where L = latent heat at absolute temperature T; $T_r = T/T_c$; and T_c = absolute critical temperature. The subscripts apply similarly.

For constructing a nomograph the equation has been transformed to:

$$\frac{L}{L_1} = \left(\frac{T_c - T}{T_c - T_1}\right)^{0.38}$$

The chart permits use of decimal factors on the latent heat or temperature scales, any latent heat units, and any temperature scale, if applied consistently.

Use of the chart is indicated for ethyl alcohol where L_1 = 204 cal. per gram, t_1 = 78.3 deg. C., t_c = 243 deg. C., and t = 180 deg. C. Here $(t_c - t)$ = 63 deg. C. and $(t_c - t_1)$ = 164.7 deg. C. Connect L to $(t_c - t)$; then connect $(t_c - t_s)$ through x to L_1; read L = 142 cal. per gram.

The variation of latent heat with temperature may also be obtained graphically from one set of values by means of a log-log plot of $(T_c - T_1)$ or $(1 - T_{r1})$ vs. L_1, using a line having a slope of 0.38, although single values are obtained quickly and accurately from the nomograph.

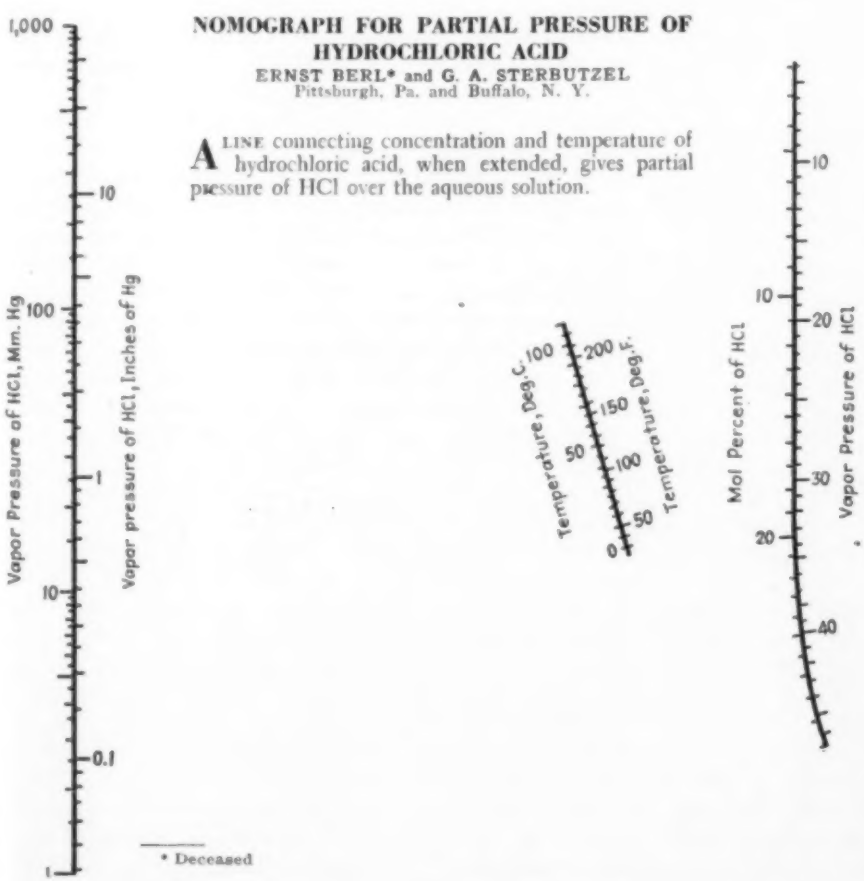
REFERENCES

Watson, K. M., *Ind. Eng. Chem.*, **35**, 398 (1943).
Hougen, O. A., and Watson, K. M., "Chemical Process Principles", Vol. I, p. 233, John Wiley & Sons, Inc., New York.

NOMOGRAPH FOR PARTIAL PRESSURE OF HYDROCHLORIC ACID

ERNST BERL* and G. A. STERBUTZEL
Pittsburgh, Pa. and Buffalo, N. Y.

A LINE connecting concentration and temperature of hydrochloric acid, when extended, gives partial pressure of HCl over the aqueous solution.



* Deceased

DID YOU NOTICE

the new rules for the Plant Notebook Contest? Starting this month the prize will be $50 cash rather than a $50 Bond.

FROM THE VIEWPOINT OF THE EDITORS——

TRANSPLANTING TECHNOLOGY

Chemical engineers and others have been translating many technical reports from the German and the other foreign languages in which wartime development has been recorded. A good linguist aided by a competent technologist can do that translating without too much trouble. But it is far more difficult to translate the technology from a foreign setting into processes that can become useful and economic under American conditions.

American technologists must use with great care many of the reports being published by Office of the Publication Board. Even the most poorly developed reports of OPB, do need to be read carefully to find whether or not there may be gems of information hidden in the careless language in which some of them are presented. The good ones are easier to read and to understand, but no less deserving of critical analysis.

Some of these reports describe technology that would be new to the United States but which on careful analysis would prove weird or worse if anyone tried to apply it directly here. All that the chemical engineer can hope to do is to make his own reappraisal of foreign activity judged in the light of American practice. The result is apt to be disappointing even on many novel ideas that seem at first glance to have merit.

In this reappraisal there is perhaps greatest importance in making a new weighing of the relative worth of money, materials, and man hours. The different relative cost of these here and abroad makes a negative economic conclusion inevitable in many instances.

A PURPOSEFUL CENTENNIAL

"If some day they say of me that in my work I have contributed something to the welfare and happiness of my fellowmen, I shall be satisfied." So wrote George Westinghouse many years before his fellows were to honor him with the John Fritz medal and acclaim him as "the world's greatest living engineer." This year we celebrate the centennial of his birth and it is particularly appropriate that on at least one occasion this should take the form of an international discussion of "Science and Civilization."

Archibald V. Hill of the Royal Society, Peter Kapitza, the great Russian physicist, Karl T. Compton of M.I.T., Hugh S. Taylor of Princeton, Robert P. Russell of Standard Oil Development Co.—these are some of the chairmen selected for the George Westinghouse Centennial Forum which convenes in Pittsburgh, May 16 and 17. Scientific ethics, the future of atomic power, of the biological sciences, of transportation as a measurement of civilization—these are some of the subjects that have been assigned such brilliant speakers as Oppenheimer and Fermi, Linus Pauling, Kettering, Warner, Admiral Land and President Clement of the Pennsylvania Railroad.

These men and the hundreds of engineers and scientists who will meet with them next month have an obligation to carry on and build for the future with the same pioneering spirit that characterized George Westinghouse's active leadership during fifty years of industrial progress. The great industries that sprung from his many inventions are but at the beginning of their contributions "to the welfare and happiness" of mankind.

NOW IS THE TIME

Much has been said in recent months about the shortage of scientists and engineers and the overcrowded conditions at the institutions of learning caused by the swelling tide of returning veterans seeking engineering education. Quantitative information, which is just now becoming available, would seem to show that the actual situation is not all that it seems on the surface. One of the most serious problems is the distribution of veterans among the various fields of learning.

Dr. Howard A. Meyerhoff, of A.A.A.S., recently advised General Hershey of Selective Service that contrary to general opinion, enrollment in engineering and scientific courses is abnormally low. On March 11 he reported: "A survey covering 110 institutions with engineering departments revealed that, during the first semester of the current academic year, the total enrollment of veterans was considerably less than the normal freshman enrollment in engineering courses during prewar years. A similar enrollment in chemistry covering 70 institutions is now in progress and is giving us the situation as it stands at the beginning of the second semester of the current academic year. Returns from most of the institutions included in this survey reveal that veteran and non-veteran enrollment in chemistry is seriously beneath the prewar norm, and that veteran enrollment accounts for less than 40 percent of the total."

Actual figures obtained from the largest accredited institutions show there is no prospect whatever of the veteran enrollment providing much more than the equivalent of one or two normal classes in a total of four. These facts, and others, have led Dr. Meyerhoff to "conclude and insist that it is a serious error to induct any competent student who is successfully meeting the rigid requirements of engineering and scientific training. We are merely increasing the shortage of highly trained personnel by such a policy, instead of making some effort to correct the deficiency incurred during the emergency of war."

The solution proposed to the head of Selective Service is most interesting and seems to us entirely logical: "This is not a case of asking for special treatment for a particular

group of students or a particular group of people. The 12 organizations which I am attempting to represent would have no objection whatever to the induction of every youth of 18, and would actually welcome the introduction of selective machinery that would screen out those with the mental qualifications for engineering and scientific study. Indeed, we would welcome this method of recruiting competent student personnel. But we believe that students with these mental qualifications should be sent to the schools to study, for they constitute replacements of a kind now needed more vitally than replacements among the armed forces. Scientific personnel was expendable without replacement during the war, and if we continue to expend it without replacement we shall pay the penalty of retarded industrial and educational recovery during the peace, and of utterly inadequate technological preparedness for the eventuality of war. The problem needs solution as urgently as the problem of placing our returning veterans in institutions of learning." Now is indeed the time to correct the errors made during the emergency of war.

LEST WE FORGET

A PROPOSED American rubber policy has been offered in preliminary form by the first report of Inter-Agency Policy Committee on Rubber. That report points out the necessity for meeting the rubber needs of America by following certain "short-run recommendations" and the observance also of "long-term recommendations." It is fortunate that this committee has recognized in the two groups of recommendations those which deal with expediency and those which deal with the long-time welfare of America. The memory of political Washington is much too short to be trusted without urgent and frequent reminder of difficulties resulting from our past experiences.

We like the thought that at no time should America be allowed to drift into such condition that it would not have a ready-to-serve capacity to produce 600,000 long tons yearly of synthetic rubber in American factories. We trust that Congress will not only remember, but also establish a businesslike basis under which American enterprise can maintain and, if necessary, operate that capacity for the good of the American people. We can do that much without destruction of the proper interests of the British and the Dutch in Malaya and the Netherlands Indies. We can not do less without sacrifice of American safety.

This rubber report deserves careful study by every chemical engineer. Each of us should see to it that our less technical friends, and our Congressmen, are properly informed as to the technical meaning of the facts set forth.

ON BACKING S. 1850

CONFLICTING policies of various groups favoring a National Science Foundation have crystallized in a so-called "compromise" measure now before the Senate as S. 1850. Few of us think that bill is perfect. But most observers who have studied the prospects for science legislation know that it is far superior to anything we had expected to get before Congress so soon.

There is one school of extremists who think that the scientists should have control of everything,—even unlimited access to the United States Treasury. There is another school, equally extreme in their views (and we have some sympathy for them), who would rather not see Congress support any scientific research, principally because it competes with the private industrial laboratories. But we also think that both schools are fundamentally in error and that some compromise or at least some harmonizing of these conflicting viewpoints is in the national interest.

Who can say that some competition of government with private laboratories may not be a good thing? Perhaps it will make us more alert. Certainly it would give us an argument to use with the boards of directors of our companies. That argument can legitimately be: "We'd better hurry. If we do not work vigorously in our own laboratories we may expect to find that some public institution has gotten there first; and we may then find that their research results are public property, available to all comers." And from what we know of past experience with governmental research, such results are not always developed promptly by competitive enterprises.

We are still hopeful that a better drafting of the patent features of the Science Foundation bill may now be brought about. There is time for that as it goes the rest of the way through Congress. But we are inclined to think that this bill is going to pass, and in a form that will do the public substantial good. Much will ultimately depend upon its administration and our responsibilities as informed citizens will not be ended with the passage of any compromised legislation. It will be up to us to continue to fight for the principles of private enterprise and to oppose any political domination of science and research.

MORE AWARD WINNERS

IN accordance with the rules agreed upon by the Committee of Award and the commanding officers of the Manhattan Engineer District (see page 110 of our February issue), a workable procedure was set up for the reconsideration of any company or university that might have been omitted inadvertently in compiling the list of recipients for the seventh biennial Award for Chemical Engineering Achievement. As *Chem. & Met.* readers may recall, the first qualification was a prime contract with MED and the second was that the contractor should have contributed significantly to the scientific research and engineering phases of the atomic bomb project.

We are pleased to announce that after such reconsideration by the Manhattan District, the following companies have now been added to the list of 118 institutions and organizations that share in this great group award: A. S. Campbell Co., Inc., East Boston, Mass.; Farrar & Trefts, Inc., Buffalo, N. Y.; Herron-Zimmers Moulding Co., Detroit, Mich.; Lukens Steel Co., Coatesville, Pa.; The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.; Henry Pratt Co., Chicago, Ill.; Republic Flow Meters Co., Chicago, Ill.; Salem Engineering Co., Salem, Ohio; Shock, Gusmer & Co., Inc., Hoboken, N. J.; Wagner Electric Co., St. Louis, Mo.; and The Whitlock Manufacturing Co., Hartford, Conn.

To all of these *Chem. & Met.*, as sponsors of this award, extends its belated congratulations and the humble apology of the Secretary of the Award Committee who will continue to serve as the clearing house for bringing the pertinent facts to the attention of the determining agencies.

PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

CORD FILTER

EXHIBITED for the first time at the 1946 Chemical Show (*Chem & Met.*, p. 130, March 1946), the Wright cord filter, manufactured by the Filtration Department of Titeflex, Inc., Newark, N. J., has been installed in the sewage treatment plant at Perth Amboy, N. J., as shown in the accompanying view. The present arrangement differs considerably from the original cord filter developed by Arthur Wright a number of years ago. In the new arrangement a vacuum drum filter is used, the face of which is divided into shallow compartments by a number of cross members serving as separators. An ingenious arrangement is provided whereby a single continuous cord is laid down on the drum in two layers. The first layer is wound many times around the drum and over a series of rollers, and then a second layer of cords is laid down to fill the interstices between the cords of the first layer. These cords also pass over rollers for discharge and for washing of the cords after discharge. Variation in the weave of the cord, or its coating, can change the porosity and provide a wide range of filter characteristics.

It is not claimed by the manufacturer that the cord idea is universally applicable or a "cureall." Nevertheless, it is maintained that a continuous filter can for the first time be operated at constant capacity without the usual decrease caused by clogging or plugging of the filter medium. Thus, liquors that tend to form scale within the drainage system and in the pores of the cloth can be handled without scaling of the cord medium. This includes sewage sludge treated on the alkaline side, sugar liquors in the carbonation process, cyanide slimes with alkaline cyanide solutions, and many chemical liquors of similar character. Cloth-plugging solids encountered in the filtration of wastes from grain alcohol distilleries and other fermentation industries can be handled, according to the manufacturer, with a drier discharge of grain, and increased yield. In fact, it is claimed, continuous filters can now be used for some applications where previously only intermittent filters were practicable.

HAND TRACTOR

FOR the pushing and pulling of industrial loads up to 6,000 lb. continuously (or up to 20,000 lb. intermittently) the Automatic Transportation Co., division of Yale & Towne Mfg. Co., Chicago, Ill., has introduced the Transtractor, a new electric-propelled hand tractor which combines features of the electric hand truck and the conventional warehouse tractor. This device, as shown in the accompanying illustration, is a battery-powered unit which is guided manually but pulls its load electrically. It is intended especially for applications that require more maneuverable equipment than standard electric tractors. The unit is equipped with a heavy duty bumper plate for pushing and a coupler for towing operations. Except for the fact that it is not equipped with a lift platform or lift forks, the unit is similar to the Transporter manufactured by this company.

OPTICAL MICROMETER

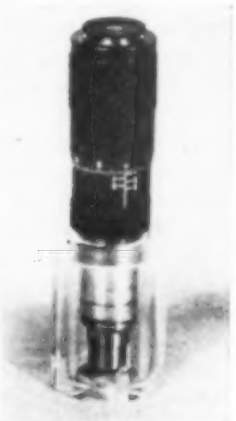
MANUFACTURERS of large sheets of transparent plastics and glass have difficulty in gaging the central portions of such sheets since they are inaccessible to ordinary micrometers. Furthermore, the measurment of curved plastic sheets is exceedingly difficult by ordinary means. To overcome these troubles the Aireon Manufacturing Corp., 166 West Olive Ave., Burbank, Calif., has developed an optical micrometer which consists essentially of a microscope that can be screwed up or down in an outer tube. The lower end of this tube is a plastic nosepiece which is held against the sheet to be measured. The transparent sheet is marked with a crayon on the side away from the instrument. The measurement consists in sharply focusing the mark in the microscope. This immediately gives the thickness of the sheet in about the same time that would be required with a purely mechanical instrument.

SPEED CHANGER CONTROL

FOR THE remote control of variable speed drives, Yardeny Laboratories, Inc., 105 Chambers St., New York 7, N. Y., has introduced the Flectrol, which consists of a control motor and remote control box, connected together by means of a flexible shaft. The motor is applied to the speed changer, as shown in the accompanying illustration. The dial on the control box can be set to any desired speed and the speed changer will follow as rapidly as the electric servomotor can drive the speed adjusting screw. The setting of the control dial is said to give precise indication of the speed to the operator. This dial can be calibrated in revolutions per minute, feet per minute, gallons per hour, or other units as desired. Any speed within the range of the speed changer

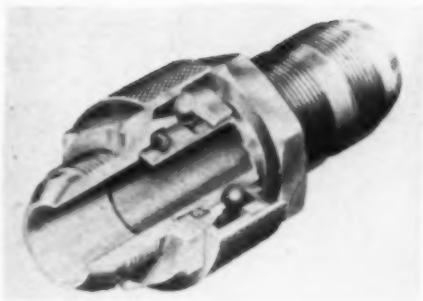
Wright cord filter installed in Perth Amboy sewage treatment plant

Optical micrometer for transparent materials

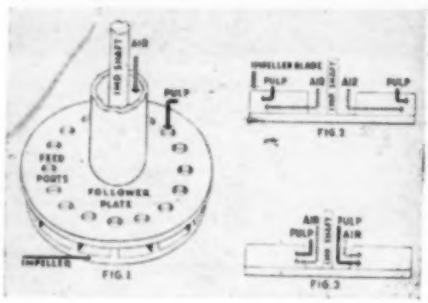


Hand guided electric tractor

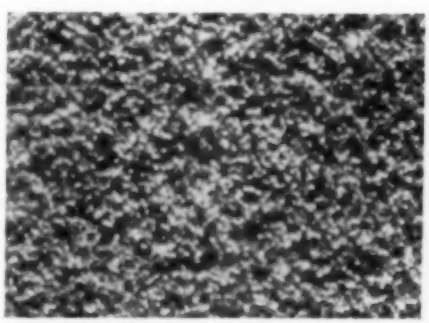
Remote speed changer control



Roylyn quick coupling



Principle of new "Outward Feed" flotation machine aerator

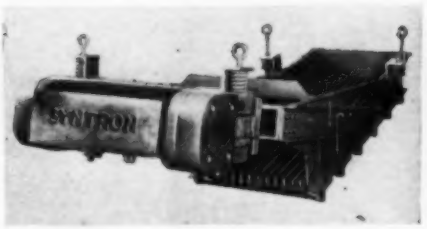


Magnified view of stainless filter medium

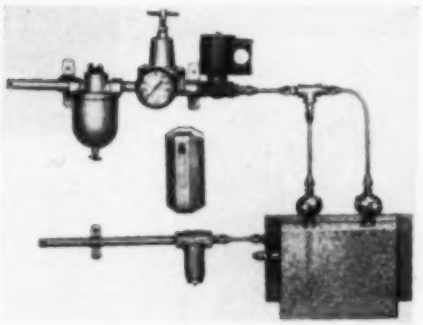
can be selected with an accuracy of better than 2 percent, according to the manufacturer. In addition to its use on speed changers, the device can be built in or added to motor-operated valves, conveyors or other equipment having motor-operated adjustments.

QUICK COUPLING

REGULARLY available in standard thread sizes from ¼ to 2 in., with larger sizes to order, a new quick coupling for hoses and lines operating under pressure has been announced by the Roylyn Mechanical Laboratory, 8928 Santa Monica Blvd., Los Angeles 45, Calif. The coupling employs three major parts, a cam ring, ball cage and nipple. By rotating the cam collar, steel balls are forced inward into a groove in the nipple, forcing the halves together. The gasket retained in the ball cage provides a positive seal against dirt, as well as the separating spring force necessary to operate the lock. Depending on the construction material and size a variety of operating pressures can be handled. For example, the alloy steel model is claimed to have a safe pressure limit of 1,680 lb. for the 2-in. coupling



Heavy-duty vibratory grizzly-feeder



Two-nozzle industrial humidifier

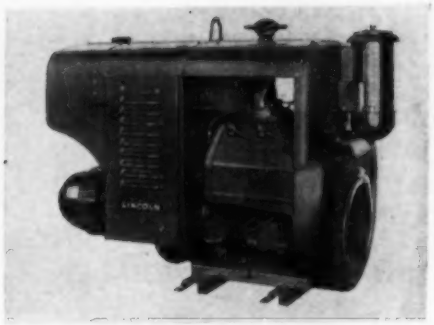
and 11,500 lb. for the ¼-in. unit. Couplings are also available in aluminum, brass and stainless steel, with gaskets suitable for handling a variety of fluids.

FLOTATION MACHINE

KNOWN as the Massco-Fahrenwald, an improved mechanical flotation machine has been announced by the Mine & Smelter Supply Co., Marcy Mill Division, P. O. Box 5270, Terminal Station, Denver 17, Colo. The new feature, which is the development of Dr. A. W. Fahrenwald, dean of the University of Idaho School of Mines, is known as the "Outward Feed" principle, as distinguished from the center-standpipe characteristic of most mechanical flotation machines. The accompanying sketches make the difference of the new machine readily apparent. The pulp to be aerated is fed by gravity through a stationary housing (not shown) through the feed ports in the stationary follower plate shown in Fig. 1, into the revolving impeller. Air enters around the impeller shaft through a tube supporting the follower plate and, as in Fig. 2, first contacts the whirling pulp at the perimeter of the feed port circle. The center portion of the impeller is, of course, kept clear of feed by centrifugal force. Fig. 3 illustrates the conventional arrangement where both air and pulp are introduced through the central standpipe. The new arrangement is said to result in greatly increased aeration, in the introduction of more air per unit of power input, in better diffusion and more uniform distribution of the air, and in ability to increase aeration with feed overloads. Impeller assemblies may be installed in metal, wood or concrete tanks provided with the necessary feed, recirculation and discharge connections.

STAINLESS FILTER MEDIUM

A POROUS filter medium produced from fully alloyed stainless steel powder, with the particles welded together at points of contact to form a strong porous body, has



Light-weight low-cost welder

been introduced by Micro-Metallic Co., 99-16 Metropolitan Ave., Forest Hills, N. Y. This product is produced in the form of thin sheets which can be bent about a small radius and can be fabricated by conventional resistance welding techniques. Its applications include filters, aeration units, breathers, flame arrestors, pressure snubbers, selective separation devices for fluids, and others. Various porosities are available, with average pore openings ranging from 4 to 165 microns.

VIBRATING GRIZZLY

A LARGE-CAPACITY, heavy-duty screening grizzly-feeder of the electrically vibrated type has been introduced by the Syntron Co., 610 Lexington Ave., Homer City, Pa. The design is such that the full length of the grizzly is utilized for material separation and discharge, actual conveying of the feed being restricted to oversize material, since the bulk of the fines are vibrated through at the rear of the trough upon introduction to the feeder. The Model F-45 feeder shown in the illustration has an actual conveying capacity, according to the manufacturer, of 200 tons per hr. The feeder can be controlled by a rheostat, enabling the operator to equalize the feed of material with the capacity of the crusher it feeds. Automatic control can be used if desired.

INDUSTRIAL HUMIDIFIER

PRODUCED as a compact unit which is delivered ready for installation, a new industrial humidifier has been introduced by Spraying Systems Co., 4023 West Lake St., Chicago 24, Ill. The humidifier is made in both two- and four-nozzle units with humidstat control, designed so that the nozzle can be set at various angles to increase the efficiency of moisture distribution. The nozzles use compressed air, mixed externally, to produce an extremely fine full-cone spray.

PORTABLE ARC WELDER

WHAT is said to be the first portable gasoline-engine-driven arc welder of inexpensive, light-weight construction is the Shield Arc, Jr., a 200-amp. welder recently introduced by the Lincoln Electric Co., Cleveland 1, Ohio. According to the manufacturer the new welder, complete with engine, sells for substantially the price that is normally paid for the welding generator alone. With a current range from 40 to 250 amp., the compact design measures 24 x 48 x 30 in., and weighs much less than usual equipment of this type and size. Control

Power factor regulator

Computer for 12 simultaneous equations

Portable Mass Spectrometer

This view shows a portable mass spectrometer tuned to helium gas for leak detection, built by Westinghouse Electric Corp., Pittsburgh, Pa., for detecting leaks in equipment used for the atomic bomb project. The sensitivity, using helium as a probe gas, is so great as to detect one part in several hundred thousand. In testing a vacuum system the mass spectrometer is attached to it and the pumps are started to evacuate the air. Then a thin jet of helium gas is sprayed against each suspected location or over the entire system. Since there is normally no appreciable amount of helium in the atmosphere, a reading immediately indicates a leak.

Swivel pipe coupling

Dry chemical extinguisher

of welding current is accomplished by adjusting the speed of the four-cylinder air-cooled engine between a maximum of 2,100 r.p.m. (22 hp.) and a minimum of 1,500 r.p.m. (16 hp.). The welder can be mounted either on the floor or on a road-type two-wheel trailer.

POWER FACTOR REGULATOR

Reactors and transformers of the dry type and capacitors filled with a non-flammable liquid which eliminates the need for fireproof inclosures are used in the Haug system of power factor regulation recently announced by Modern Control Co., 176 West Madison St., Chicago, Ill. According to the manufacturer, shunt capacitors hitherto used without control circuits for power factor correction have been instrumental in provoking circuit conditions requiring either their removal or the need for providing costly corrective measures. The new system has no moving parts, requires little or no maintenance, is small in size and can be installed in almost any desired location. This system raises the power factor by taking the magnetizing or wattless current off the line, the regulator itself providing the necessary magnetizing component. It is claimed that the use of this equipment greatly reduces the monthly power bill, increases low voltage to the desired value if voltage was previously low due to poor power factor, and improves voltage regulation. Current consumption of the capacitor itself and its control circuit is negligible.

DRY CHEMICAL EXTINGUISHER

All-out is the name of a new dry chemical extinguisher which utilizes gas pressure for discharge of its flat stream of dry chemical extinguishing compound. It is manufactured by Pressurelube, Inc., All-Out Fire Extinguisher Division, 609 West 134th St., New York 31, N. Y. The extinguisher meets the requirements of Associated Factory Mutual Laboratories and Underwriters Laboratories. It is said to perform effectively under all climatic conditions, in extreme temperatures, and in the presence of winds or drafts. Instantly forming a dense, fire-smothering cloud over a flaming area up to a distance of 18 ft., the chemical cloud is said to create an insulating barrier between the operator and the flame, thus providing protection from radiant heat. The chemical used forms no toxic gases, is a non-conductor of electricity, is non-abrasive, and is harmless to finished surfaces.

ELECTRICAL COMPUTER

Originally developed for the solution of mass spectrometer and infra-red spectrometer data, a new electrical computer, which is also suitable for other applications involving linear simultaneous equations, has been announced by Consolidated Engineering Corp., 620 North Lake Ave., Pasadena 4, Calif. The new instrument is based upon the "Gauss-Seidel" or "Classical Iterative" method, employing highly stable circuits and rugged components. It provides a means for the rapid and accurate solution of any number of simultaneous equations up to and including 12.

In use, the instrument provides a series of increasingly accurate approximations, each step consisting merely in adjusting a circuit to a balance or null condition, with the instrument itself "remembering" the previous approximation as long as necessary. Convergence to an accurate solution is assured for most practical problems by the proper arrangement of the data set into the computer. It is claimed that this new instrument reduces computation time over mechanical calculators to one-fifth to one-tenth, the inherent accuracy being great enough for most engineering applications. Errors introduced by the computer in analyzing are negligible on mass spectrometer or infra-red data. Easy to operate, the instrument requires only a short training period for those with average manual dexterity and a mathematical background limited to arithmetic.

The computer operates on 115 volt, 50-60-cycle current, is unaffected by normal line voltage fluctuations and draws only 100 watts. Its size is 25 x 33 x 19 in. weighing 200 lb. The weight of the power supply is 35 lb.

SWIVEL PIPE COUPLING

Transmission of fluids under high pressure through a pipe which swivels or rotates through a full 360 deg. is possible with the new All-Flex ball-bearing swivel pipe coupling. This development of Snyder Sales Corp., 5225 Wilshire Blvd., Los Angeles 36, Calif., employs a combination of multiple synthetic packings and metallic seals which is said to assure absolute freedom from leakage at both high and low pressures. A double row of ball bearings, plus metal-backed packings, is said to give lowest possible resistance to rotation, permitting ease of operation at all pressures. Available sizes range from $\frac{1}{2}$ to 1 in. normal tube size, with a variety of threaded and elbow connections to meet particular needs. The coupling is designed to operate at an average speed of rotation not over 250 r.p.m., and

at pressures from 0 to 3,000 lb. per sq.in. Operating temperatures normally range from 0 to 150 deg. F.

GAS TURBINE

THE GAS TURBINE unit shown in an accompanying view is an experimental unit built by Allis-Chalmers Mfg. Co., and installed at the U. S. Naval Engineering Experiment Station at Annapolis. Designed and built for eventual operation with hot gas at a temperature of 1,500 deg. F., this 3,500-hp. unit is being tested in a series of successively increasing temperature runs. It has now been operated successfully at a gas temperature of 1,350 deg. F. and will eventually, it is anticipated, reach the design temperature of 1,500 deg. F. This is the first large multi-stage gas turbine unit for continuous power generation at high efficiency ever operated successfully at such a high temperature. Although designed as a Navy project, the basic elements of this turbine have characteristics similar to those required for land use. The unit embodies innovations in cooling to permit high-temperature operation. Two turbines operate in parallel, one supplying the power required to drive the compressor, the second furnishing the power needed to drive the driven machine or dynamometer.

APRON CONVEYOR

SEVERAL widths, with centers ranging from a minimum of 4 ft. 7 in. to a maximum of 9 ft. 1 in., varied by 18-in. increments, are available in a new line of completely self-contained, factory-assembled, heavy-duty apron conveyors announced by Chain Belt Co., Milwaukee, Wis. Feeders of this type are used extensively under bins and hoppers for heavy lump material. At a normal speed of 10 ft. per min., handling 100-lb. material, capacities of standard units will run up to 80 tons per hr. Because the heavy steel chain belt rides directly on large diameter traction rollers, it is claimed that the new heavy-duty feeder offers longer chain life and reduced power consumption.

AUTOMATIC LUBRICATOR

MANUFACTURING rights on the Gun-Fil lubricator have been acquired by the Gray Co., Minneapolis 13, Minn. Designed in four sizes, with lubricant capacities ranging from ½ to 8 oz., these pressure-filled lubricators automatically dispense oil or grease in a measured uniform flow to a moving bearing—and stop feeding lubricant when a bearing becomes motionless. It is claimed that the precise amount of lubricant needed for each individual bearing is thus provided. Six interchangeable valves are available with distinctive colored caps for identification. These exert varying degrees of control of feed on greases of different densities.

OPERATION RECORDER

FOR PROCESS timing and time study work the Ess Instrument Co., Bergenfield, N. J., has introduced an operation recorder that provides a continuous record of "time on" and "time off" of multiple operations. The instrument can be supplied with a single-acting pen, a two-position double-acting pen, or a three-position pen, while as many as six single- or double-acting pens can be combined on a single chart. Double-acting pens are now being used in this company's "Normality Indicators" which are used to record the operation of a variety of kinds of indicator. When operation is normal a circle is traced. If the process goes too far in one direction the pen moves outward and remains there until "normal" is resumed, when the pen returns to the center point. If the process goes too far in the other direction, the pen moves to the other side of "normal" and remains there as long as the condition persists. As many as six of these three-position "Normality" pens can be placed on a single chart to give a complete picture of the "normality" of six processes simultaneously.

DISCHARGE CHECK VALVE

TO GIVE positive protection against back surge in discharge lines carrying steam, sludge, waste water or other waste liquids in gravity flow installations, the J. A. Zurn Mfg. Co., Erie, Pa., has announced a new discharge check valve. This valve is equipped with a swing check flap suspended from a full-floating pin fulcrum to insure positive contact between the ground face of the flap and the flap seat. The valve may be operated with or without a manual control or with an extension shaft or flexible cable from an access box. Operating pressure is 150 lb., and valves are available in 180-deg., 105-deg., and 90-deg. bodies of cast bronze, steel, semi-steel, cast iron or alloyed metals.

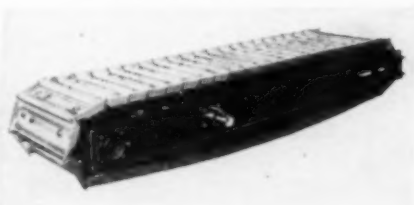
GAS MEASURING INSTRUMENTS

DAVIS EMERGENCY EQUIPMENT CO., 45 Halleck St., Newark 4, N. J., is extending its line of gas detection and gas analysis instruments to include new types of safety equipment for the detection and analysis of combustible gas or vapor in air, for measuring gas or vapor air mixtures, and for detecting and analyzing for any one gas, whether or not combined with other gases. These instruments, of the thermal conductivity type, will be available with direct reading meters or circular chart or strip chart recorders, and may incorporate control equipment.

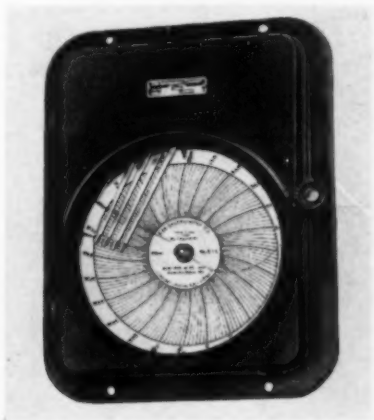
PRESSURE SWITCH

FOR THE handling of liquids or gases that will not corrode brass, three new pressure switches for either pressure up to 200 lb., or vacuum, are now available from the Areotec Co., White Plains, N. Y. The switches are rated at 10 amp., 110 volts a.c., and are produced in three designs, one

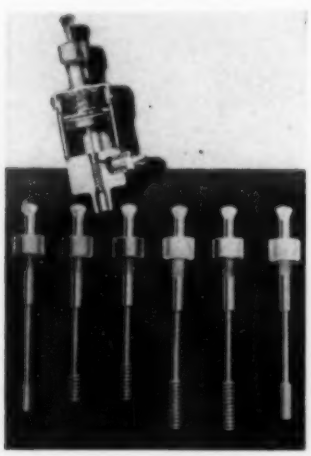
Heavy-duty apron conveyor



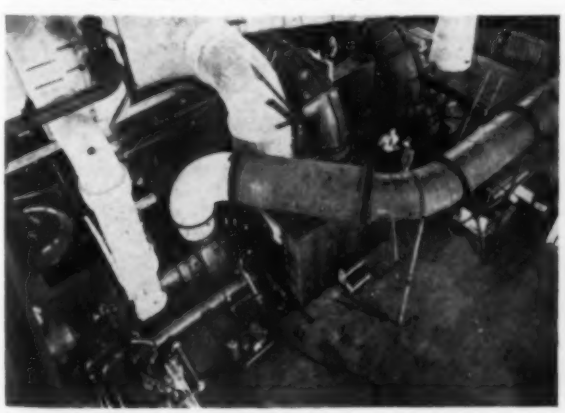
Four-pen operation recorder



Gun-filled lubricator



High temperature experimental gas turbine unit



Discharge check valve

having an externally adjustable range with a fixed differential, another arranged for manual resetting from the outside, and the third with an adjustable differential. Several contact arrangements can be secured with the first two types and normally open contacts with the third.

EQUIPMENT BRIEFS

HANDLING of materials in narrow aisles and in close quarters is the function of the new Handy steel all-welded truck announced by the Schmidgall Mfg. Co., 307 Cass St., Peoria 2, Ill. Designed for handling barrels, kegs, and sacked materials, as well as boxes or crates, the truck has a single handle to permit the handling of bulky and heavy loads with one hand. Its capacity is 500 lb. It is equipped with bronze-bearinged wheels and molded rubber tires.

A NEW LINE of streamlined pressure gages in modernized design is being offered by the United States Gauge Division, American Machine & Metals, Inc., 233 Broadway, New York 5, N. Y. The working parts have been improved after years of tests, so that it is claimed that longer life under adverse conditions is assured.

IMPROVEMENTS have been announced by the Alden Speare's Sons Co., 156 Sixth St., Cambridge, Mass., in the Safety Siphon originally developed in late 1942. The improved model fits 6- and 6½-gal. carboys (as well as larger ones), whereas the old siphon would not. Furthermore, the flow valve has been redesigned to incorporate an indicator of the "on" and "off" positions. The siphon is produced from an inert plastic and is designed to be easily and quickly primed by a built-in pump. The entire contents of the carboy may be discharged by the siphon by manipulation of the flow control valve which may be adjusted from a tiny trickle to a fast, steady flow.

TO PRODUCE a fog for fire fighting, a new fire control nozzle for fixed installations has been announced by the Blaw-Knox Sprinkler Division, Pittsburgh, Pa. Named the Aquatomic fog nozzle, the device is said to be particularly adapted to protection of tanks containing flammable liquids, either in tank farms or housed in buildings. The fog is produced by forcing water through three clear spiral passages and a central passage in the head of the nozzle. The fog pattern is said to be maintained even at greatly reduced water pressure, while air currents are claimed not to affect its action.

SHADOWCOUNT is the name of a new photoelectric counter, capable of high counting speed, that is manufactured by the Autotron Co., Danville, Ill. The maximum counting speed is 1,000 per min. In most cases the instrument is installed in the production line, and when possible it is so placed that objects, as they are made or processed, can fall directly or by way of a chute, into a guide tube at the top of the instrument.

KNOWN as the Hi-Temp furnace, a new small electric furnace with automatic control for continuous operating temperatures up to 2,200 deg. F. has been announced by the K. H. Huppert Co., 6830 Cottage Grove Ave., Chicago 37, Ill. Available in both floor and table models, these furnaces are furnished complete with automatic temperature control, for operation on 110-volt a.c. current at a current consumption rate of 2 kw.

FOR PLANTS that permit smoking in safe areas, Standard Industrial Products Co., 1710 Main St., Peoria, Ill., has developed the Sipco Safe Smoker, which consists of a small metal canister that in use is partially filled with water. It is fitted with a hinged cover having a hole for the introduction of ashes and smokers' debris and can be attached to the wall, or to a machine, or provided with a stand. Large signs calling attention to the receptacle are available.

CALCULATIONS needed in the design of heating systems are handled automatically by a circular slide-rule like device introduced by Heat-O-Meter, 424 West 42nd St., New York 18, N. Y. The device performs the calculations required in figuring radiation for steam and hot water systems. It also contains information on sizes of mains, returns, risers, radiator sizes and capacities, and other needed data.

FLEXIBLE COUPLING

SERIES A is the designation of a new gear-type flexible coupling announced by the Coupling Division of John Waldron Corp., New Brunswick, N. J. It enables a smaller sized coupling, requiring less space, to be used. The coupling has been designed for a much larger maximum bore, hence permitting the use of smaller size couplings than would ordinarily be required. With a smaller coupling first cost and maintenance are less. Basic construction features of this company's earlier line of couplings have been retained. The coupling is made entirely of steel, to close manufacturing tolerances, and is dustproof, oil-tight, and inclosed as a single, rigid unit.

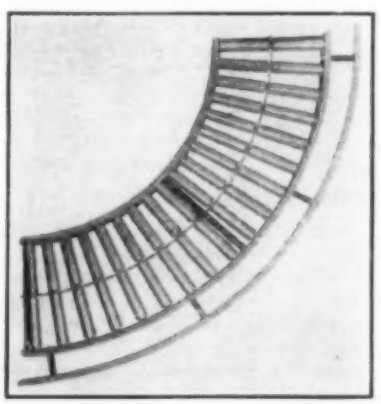
GRAVITY CONVEYOR

THREE widths of 12, 18 and 24 in. are available in the new line of "packaged" gravity roller conveyors now being marketed by Lyon Metal Products, Inc., Aurora, Ill. These conveyors are adapted to the handling of cartons, packages, boxes, crates and other articles, and are built in straight sections 10 ft. long, and in 90-deg. curved sections. Trestles are also produced in widths suitable for the various conveyor widths. A variety of arrangements can be built up by using straight runs and curves in different combinations. The conveyors have a clean, finished appearance, and because the rollers are set slightly above the level of the tops of the side rails, packages larger than the width of the conveyor section can be handled. These conveyors, regardless of width, will handle loads up to 200 lb.

CARBON DIOXIDE ENGINE

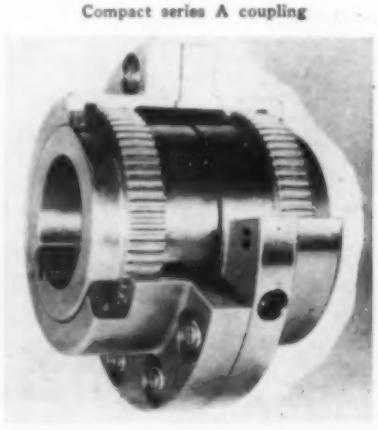
DESIGNED to provide broad protection coverage at comparatively small cost, a new model wheeled portable fire extinguishing unit, having a capacity of 750 lb. of liquid carbon dioxide, is now being produced by Cardox Corp., 307 North Michigan Ave., Chicago 1, Ill., under the name of Cardox Transitank. Owing to the fact that a single nozzle can supply 300 lb. of carbon dioxide per minute, a single operator shielded behind the cooling screen afforded by this mass discharge can extinguish a relatively large fire in a matter of seconds, according to the manufacturer. Liquid carbon dioxide is stored in a refrigerated and insulated pressure vessel at approximately 0 deg. F., and 300 lb. per sq. in. When released, this liquid carbon dioxide is said to yield 47 percent "snow." The unit is readily portable and is available both in a self-powered model driven by a gasoline engine, and in models equipped with rubber-tired wheels or casters for towing or hand-propulsion to the point of fire.

Curved roller conveyor section



Portable 750-lb. carbon dioxide extinguisher

Compact series A coupling



REPORT ON.....

WEIGHT CONTROL

A Valuable Tool of Process Industries

Weighing is an indispensable tool of industry. Today, more than ever before, engineered weight control systems perform many essential functions. An integral factor of both process and cost control systems, weighing has passed far beyond the traditional limits of merely measuring incoming raw materials and finished products to play an increasingly important part in plant operations. Modern plants and processes are now designed to utilize modern automatic weighing equipment available for a wide variety of purposes. This report, by Douglas M. Considine,* chemical engineer, Philadelphia, Pa., describes the principal mechanisms and outlines many important functions and applications of weighing in the process industries.

WEIGHING is an operation too often taken for granted in descriptions of the chemical process industries. Frequently, consideration of scales and weighing is confined to the routine receipt of raw materials and the shipment of final products. Although weight control at these points is important it must be emphasized, that, to many chemical processes, weighing, as a form of process control, is possibly the most critical operation. This is especially true of processes where the yield and quality of the final products depend upon the exact proportioning of the raw ingredients or reactants.

Many advances in the engineering of scales and weighing systems have been made during the past few years. As a result of these advances, weighing, in many cases, has become almost completely automatic. The time and labor required for weighing have been reduced substantially and the chances for human error have been practically eliminated. Weighing at one time was necessarily a batch operation. Today, the automatic scale makes possible a complete integration of weighing with other operations in a process. Engineering of the weighing system and of the materials handling system, often with elaborate mechanical and electrical interlocking, commonly is handled as a cooperative effort between the scale and the materials handling equipment manufacturers.

PROCESS AND COST CONTROL

Weighing in the process industries is of principal importance to process control, and cost control. In process control, the major applications of scales are in (1) continuous feeding, (2) continuous proportioning, (3) batching, and (4) product testing.

In cost control, scales and fluid flow meters are the accountant's principal means for collecting data regarding the flow of materials through the plant. In this regard, weighing is important to (1) materials receiving, (2) inventory control, (3) interdepartmental transfers, (4) production scheduling, (5) wage payments, (6) packaging, and (7) shipping.

A steady flow of starting reactants or raw ingredients is a major requisite for continuous processing. Pumps and flow meters of various types successfully handle the feeding of most liquids. Continuous weigh feeders are commonly used where solid materials are concerned. The latter feeders are used widely, for example, in charging crushers, grinders, roasters, dryers, furnaces, ovens, and the like.

Essentially, continuous weigh feeders function to maintain a continuous flow of material at a predetermined weight-per-minute or weight-per-hour rate. These machines are available with capacities ranging from a few pounds per hour up to several tons per hour and are capable of handling powdered materials of fine mesh as well as larger, lumpy materials.

CONTINUOUS WEIGH-FEEDING

Weigh feeders take numerous forms, but generally they can be classified into two groups, namely: the pivoted belt, and the loss-in-weight hopper.

Pivoted belt feeders comprise a feed hopper, an endless traveling belt mounted

* Mr. Considine is the author of a comprehensive book on industrial weighing and weight control, upon which this report is largely based. The book is to be published soon by the Reinhold Publishing Corp.

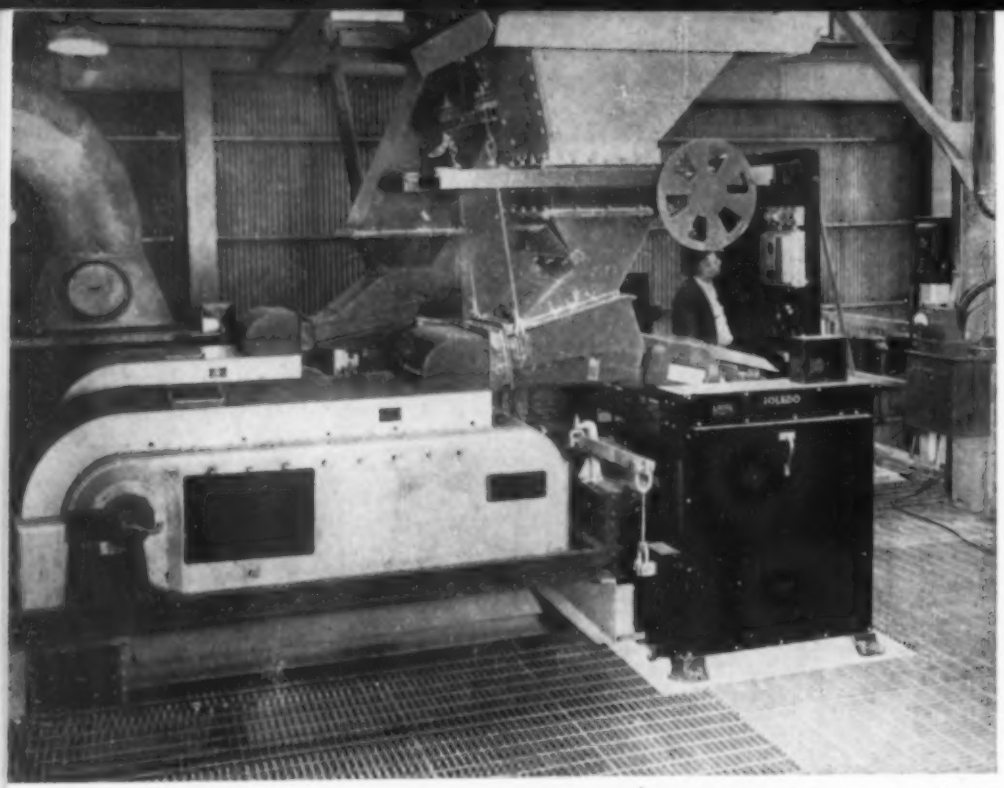


Fig. 3—Two dust-tight weigh feeders for proportioning limestone to shale

on a pivoted frame, an adjustable weight which counterbalances the load on the belt, and a means for continuously and automatically adjusting the feed of material to the belt.

PIVOTED BELT FEEDERS

Materials generally flow to the feeder from a hopper. If the feeding operation is to be substantially constant, it is obvious that the over-all rate of flow of material to the feeder must equal the overall rate of flow from the feeder. Otherwise, the feeder will become completely exhausted in a time, or material will build up unduly so that it will interfere with the feeder operation. The secret of continuous weigh feeding is to cause a smooth, relatively constant flow of material to the weight-sensitive element of the feeder, the latter mechanism functioning to make continuous and smooth adjustments in this rate of feed, all to the end purpose that material will flow from the feeder smoothly and at a constant rate.

Control of material flow to the feeder is accomplished in either of two general ways, namely: (1) by means of a restriction, such as a gate placed in the passage between the feed hopper and the belt, or (2) by controlling the amplitude of vibrations in a vibrating deck placed between the feed hopper and the belt. Control in either case can be accomplished electrically or mechanically.

A unit in which the rate of flow of material to the belt is controlled by changing the position of a gate over the outlet of the feed hopper is shown diagrammatically in Fig. 1. Note that the feed gate is linked mechanically to the pivoted belt frame so that a downward tilt of the belt, resulting from the load running too heavy, will automatically cause partial closing of the feed gate. The reverse action occurs when the load runs light. Thus, the feeder automatically compensates for changes in the feed material to maintain an overall constant weight rate of feed.

A unit in which an electrically controlled vibrating deck is employed to charge the pivoted belt is illustrated schematically in Fig. 2. When properly adjusted to the desired feeding rate, the scale beam is level and neither the over- nor the under-contact is made. When the belt tilts downward, indicating that the flow of material is excessive, the over-contact at the end of the scale beam makes, which actuates a rheostat, decreasing the amplitude of vibrations in the deck and hence throttling the flow of matrial to the unit. When the belt tilts upward, indicating a deficiency in the flow of material, the under-contact makes, which increases the amplitude of vibrations, resulting in an increased flow of material.

The units are available with two types of adjustments for changing the rate of feed, namely: (1) a constant speed belt with adjustable counterpoise, or (2) a variable speed belt with constant counterpoise. The first arrangement is most commonly used, since it is the simplest and least expensive. The adjustment can easily be made by the operator. The second arrangement is employed where adjustments must be made from a remote point and usually is used where the proportioning of several ingredients is required.

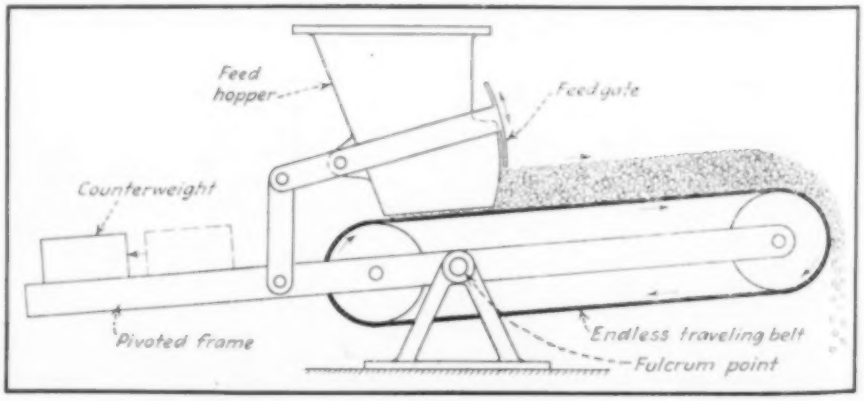
Pivoted belt feeders are available with numerous accessory devices and refinements, including: (1) counters which totalize the flow, (2) recorders which provide permanent records of the flow rate, (3) no-load cut-offs which automatically stop the feeder and sound an alarm should the material supply become exhausted, (4) flush control (Syntron), which automatically corrects for sudden flushing of materials from the feed hopper, and (5) attachments for proportioning liquids with solid materials.

The loss-in-weight type feeder is based upon the rate of weight loss of a hopper or tank rather than upon the instantaneous weight of a moving conveyor belt. In essence, the feeder comprises a hopper or tank suspended from scale levers, a means for throttling the flow of material from the hopper or tank, and a scale beam with electrically driven counterpoise which fixes the rate of flow from the unit. The hopper must be recharged periodically.

LOSS-IN-WEIGHT FEEDERS

As the counterpoise slowly travels along the beam, it tends to unbalance the beam at the rate at which feeding is desired. The scale and beam can be brought back to balance only by causing material to flow from the hopper or tank, resulting in a loss of weight. Various means are used to translate the scale beam unbalance into movement of the hopper gate or tank valve. In one system, this unbalance is detected by the flapper mechanism or free-vane of a pneu-

Fig. 1—Hardinge weigh feeder with mechanically interlocked gate type feed



matic control instrument, resulting in corrective action by means of a valve positioner and diaphragm control valve, where liquids are handled; or a gate-positioning power cylinder, where solid materials are handled.

The capacity of this type of feeder is limited only by the scale lever system which supports the hopper or tank. As with the pivoted belt type feeder, numerous refinements and accessories are available.

WEIGH-FEEDERS ARE NOT SCALES

It is important to note that the devices just described are termed *weigh feeders* and not *scales*. There is an important distinction between these two terms in that weigh feeders are not recognized by weights and measures officials as scales and, therefore, can not be sealed. Feeders utilize the weight of a flowing material to make adjustments in feeding so that a relatively constant flow—on a weight basis—is obtained. Note, however, that these feeders do not weigh first and then feed, but feed first and then check and adjust that feed through weighing. Although many of these feeders cause a substantially constant flow over a given period, with the over- and underweight increments of feed averaging out, it can not be stated that the flowing material has been truly weighed and, hence, feeders can not be classified as scales proper. For feeding critical processes, weigh feeders may be checked periodically by collecting a stream of material over a timed period and weighing the collected material on an accurate scale.

CONTINUOUS PROPORTIONING

The weigh feeders just described are commonly used for continuously proportioning two or more ingredients, solids, or liquids, to a process.

Proportioning Solid Materials—In cement manufacture, for example, it is desirable to weigh-proportion limestone and shale in an early stage of the process, and later to weigh-proportion gypsum and clinker. Pivoted belt feeders are adapted to these applications.

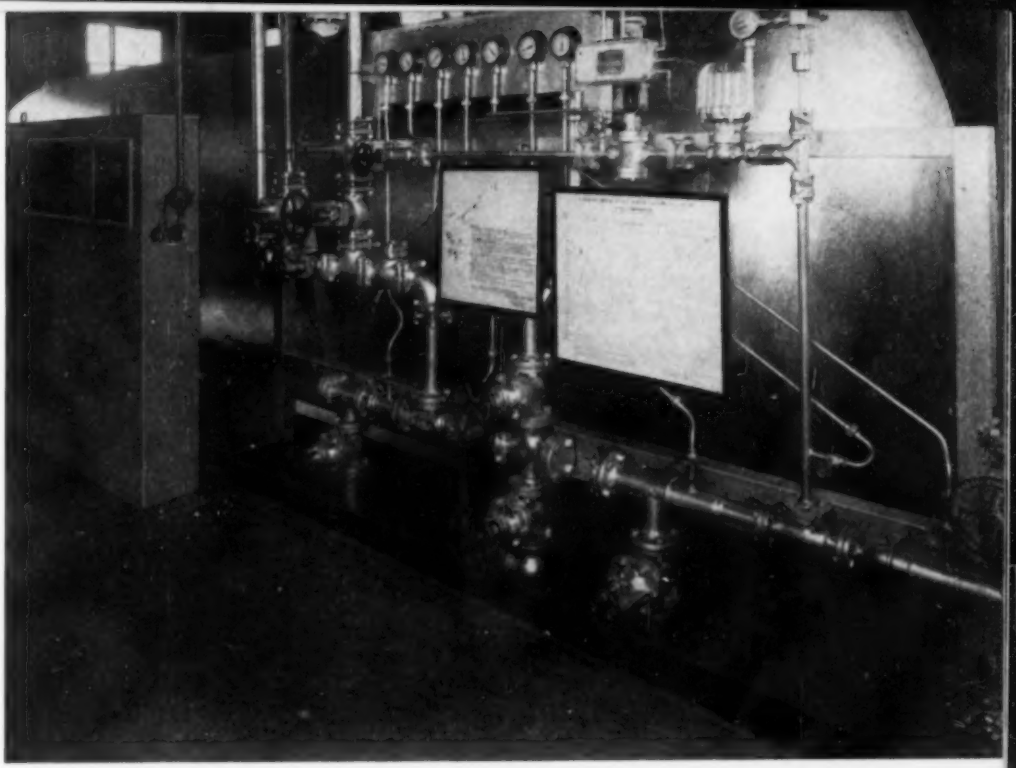


Fig. 4—Loss-in-weight continuous feeder proportioning Ethyl fluid to gasoline

Limestone and shale generally are proportioned ahead of the grinder so that advantage of the mixing action during grinding can be taken. In addition to weigh-proportioning these ingredients, the efficiency of the grinder must be considered. Two main theories have been advanced regarding crusher and grinder efficiency, namely: (1) Kick's law which assumes that the energy required for crushing materials is proportional to the logarithm of the ratio between the initial and final diameters, and (2) Rittinger's law which is based on the assumption that the energy required for crushing is proportional to the surface sheared. It is obvious, therefore, that simply feeding a crusher or grinder at a constant weight-per-time, or volume-per-time rate will not assure operation of the machine at maximum efficiency.

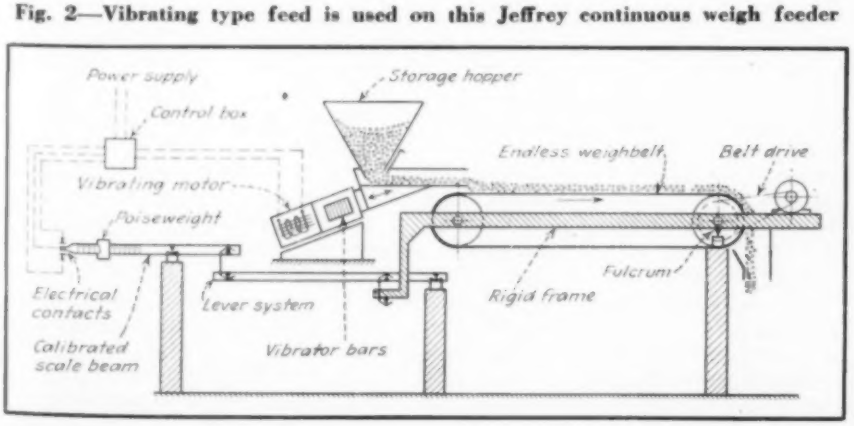
Some efforts have been made to measure the amperage of the current drawn by the driving motors of the grinder and to control this amperage to maintain constant grinding efficiency by adjusting the rate of feed to the grinder. Obviously, controlling the feed at a constant weight rate will substantially aid in smoothing out a grinder control system. Weigh feeding for this application has three major advantages, namely: (1) provides an accurate basis for proportioning the ingredients, (2) aids in maintaining the grinder at constant efficiency despite variations which may occur, and (3) the totalizers or recorders on the feeder supply valuable production and cost accounting data.

DUST TIGHT CONSTRUCTION

Two continuous weigh feeders of dust-tight construction, one for feeding limestone and the other for feeding shale, are illustrated in Fig. 3. Both feeders discharge to a common grinder which is controlled on the basis of amperage required. The weigh-belts of the feeders are driven by Selsyn motors which are interlocked with the grinding circuit, such that their speed is reduced if the amperage required by the grinder goes up, and is increased if the amperage goes down. The units are adjusted, of course, to maintain a constant weight proportion of limestone to shale regardless of the belt speeds.

Proportioning Liquid Materials—Blending tetraethyl liquid with gasoline is an example where the loss-in-weight type feeder finds application. In the installation illustrated in Fig. 4, an Ethyl fluid storage tank of 8,500-gal. capacity is mounted on a 60-ton built-in scale. The unleaded gasoline, on its way from storage to the Ethyl blending unit, passes through a venturi tube which, in connection with a differential type flow meter, measures the flow of gasoline. Changes in this flow are transmitted as electrical impulses to the counterpoise driving motor on the scale beam, which

Fig. 2—Vibrating type feed is used on this Jeffrey continuous weigh feeder



drives the poise at a slower or faster rate as required. Unbalance of the scale beam is detected by a pneumatic control instrument which throttles the amount of Ethyl fluid passing through a diaphragm control valve. Thus, correct proportioning is constantly maintained regardless of a changing gasoline flow.

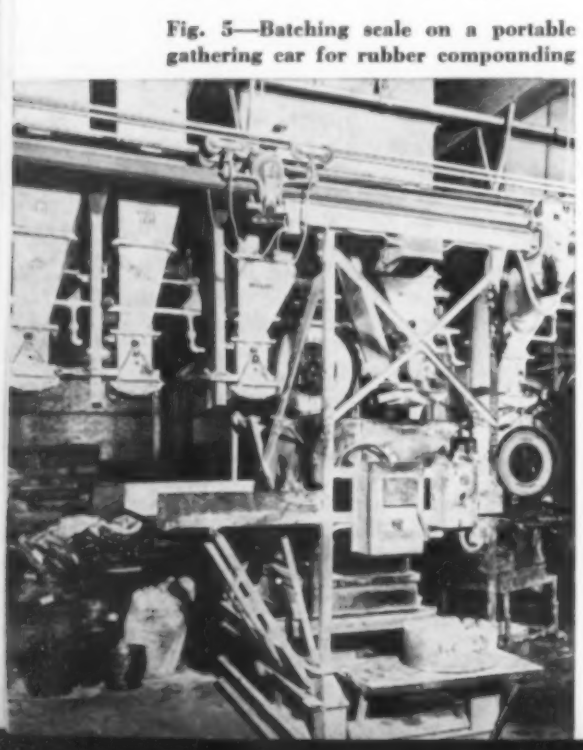
The unit also incorporates a system of safety devices and audible alarm signals, which sound in case of eductor pump failure, air pressure failure, vacuum failure, and high or low scale beam. In connection with the latter alarms, it is to be noted that the scale beam is level when correctly operating, thus the reason for high and low alarms.

AUTOMATIC WEIGH-BATCHING

Automatic batching scales are used widely in batch and semi-continuous processes to automatically weigh out a single batch or a series of batches of materials. Processes requiring systems of this type include the batching of ingredients for rubber, glass, alloy steels, explosives, etc. By interlocking several automatic hopper scales, a system capable of batching several ingredients, completely automatic in timing and operation, can be engineered.

An automatic hopper scale consists essentially of: (1) a storage space, usually in the form of a hopper or bunker, for supplying material to the scale, (2) a means for feeding material to the scale, (3) an automatic device to start and stop materials running into the scale, with provision for dribbling the last amounts of feed into the weigh hopper, (4) a weigh hopper, suspended from the scale lever system, (5) a device for continuously counterbalancing and indicating the load in the weigh hopper, and (6) a means for discharging material from the weigh hopper to the process. The counterbalancing mechanism often takes the form of a double-pendulum which is common in conventional dial type scales.

Fig. 5—Batching scale on a portable gathering car for rubber compounding



The principal methods for feeding materials to the weigh hopper include the gate feed, screw feed, conveyor belt feed, and vibrating feed. The latter type is best suited to close control, especially where materials which tend to arch and flush are handled, and therefore, is in common usage.

TREND TO AUTOMATIC

Early efforts for correct proportioning of raw materials in batch processes often consisted of the foreman directing a workman to fill a large box or hopper to a crudely marked level with the desired ingredients. Materials used in smaller quantities were measured by equally inexact methods. As the needs for better yields and higher product quality became greater, the large box or hopper was mounted on a scale platform and an immediate improvement in the uniformity of proportions was obtained. Batch proportioning by this latter method required that supply bins be closely grouped around a centrally located weigh hopper.

Several of the obvious inconveniences of the above arrangement were relieved by rearranging the supply bins, locating them in a line, one beside the other, and over a batch gathering tunnel. With this arrangement, a portable gathering car, as illustrated in Fig. 5, equipped with a scale, could operate below the bins, collecting the materials one at a time. Aside from the improvement in batch handling conditions, the major change was that the earlier fixed weigh hopper and scale were converted to a portable unit, acting as a scale and as a truck. There were two serious disadvantages to this arrangement, namely: (1) smaller quantities of more critical materials were weighed on a scale designed for the much larger quantities, resulting in inaccuracies, and (2) use of the scale as a truck with attendant rough handling in a generally dusty and abrasive atmosphere, quickly tended to destroy the original sensitivity of the scale.

The above objections were overcome by installing a dial scale of the proper capacity and sensitivity under each supply bin, with no scale on the traveling batch car. Weighing accuracy was improved and scale maintenance was reduced. With reliance on the accuracy of manual weighing as required by this system, however, great care was required in hiring reliable operators. It was often found, for example, that the operator omitted some ingredient from the batch, or weighed two portions of some other raw material. Frequently, these errors did not show up until later in the process, sometimes several hours after weighing. In any event, the errors usually were discovered too late to make the required corrections. These stages in the development of automatic batching are cited because even today, there are many plants which still employ such antiquated batching systems. Two major improvements remained to be made: (1) elimination of the human error in weighing, and (2) speeding up of the batching operation.

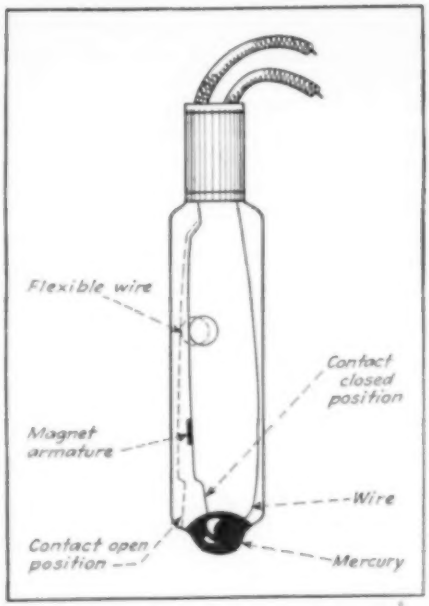


Fig. 6 — Mercury-magnetic contact manufactured by the Toledo Scale Co.

MODERN BATCHING SYSTEMS

As indicated above, the accuracy and sensitivity of the conventional dial type scale are quite satisfactory for batching operations. Many modern automatic batching systems, therefore, use scales of this type, equipped with automatic controls to render them and the weighing operations which they perform almost totally automatic. The two general types of electrical controls used are the mercury-magnetic cut-off, and the photo-electric cut-off. Since these controls can be adapted to nearly any standard dial scale they provide an extremely wide selection of scales for automatic batching operations.

Both types of cut-offs allow the scale to make or break one or more contacts when the desired quantity of material has been weighed on or off the scale. These electrical contacts may be used to start or stop a conveyor, a vibrating feeder, a pump, to open or close a valve, and frequently to perform other process operations, such as opening or closing a furnace door, or starting or stopping a mixer.

Mercury-Magnetic Cut-Off—With this arrangement a mercury-magnetic contact, illustrated in Fig. 6, is used. This contact comprises a small vacuum tube in which is contained a drop of mercury and a flexible wire, the end of which contacts the mercury when in a closed position. On the flexible wire is mounted a magnet armature, which draws the wire out of the mercury when subjected to magnetic attraction, causing the electrical contact to be broken. The contact tube is mounted on an adjustable

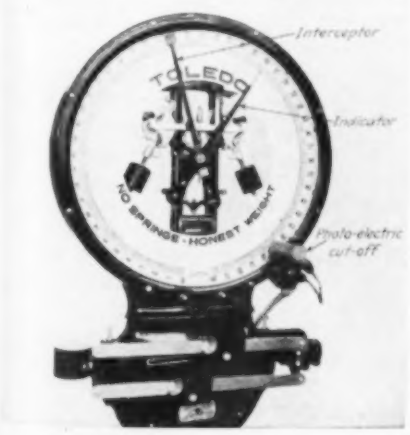
bracket located at the lower section of the scale dial housing diametrically opposite the zero position on the dial and very close to the plane of dial indicator travel. A small permanent magnet is attached to the scale indicator by a small arm and when the indicator is in the zero position, the magnet attracts the armature on the flexible wire in the vacuum tube, causing contact to be broken.

In operation, with no load on the scale, a poise on the beam is set to the desired weight, whereupon the dial indicator revolves in a clockwise direction from the zero graduation and comes to rest at a position on the dial equivalent to the poise setting. The load is then applied to the scale whereupon the indicator revolves back toward zero in a counterclockwise direction and cut-off takes place when the indicator reaches the zero graduation.

Where feeding rates to the scale are quite rapid and where there is little time to accumulate material on the scale, a double cut-off is employed. This arrangement simply consists of one contact mounted in the zero position and second contact mounted several dial graduations away from zero. In this manner, the zero contact causes a final cut-off of the feed, but the other contact causes a dribble feed, thus eliminating the chance of overweight in the batch.

Photo-electric Cut-Off—In this arrangement, as shown in Fig. 7, an interceptor is incorporated on the scale dial indicator shaft and revolves about the dial just as the indicator revolves. A photo-electric cell is mounted on the scale head so that the light-sensitive portion directly faces a section of the dial. When the interceptor passes between this section and the photo-electric cell, an electrical contact is made or broken, as required by the process. Dribble feed is accomplished by incorporating a slit in the interceptor so that two contacts are made by the photo-electric cell, the dribble contact being made a few graduations before the zero position is reached. The position of the interceptor is adjusted by means of a center knob, accessible from outside the scale dial.

Fig. 7—Photo-electric cut-off used in dial type automatic batching scale



Where it is desired to automatically control the feeding of the scale as well as the discharging operation, two photo-electric cells are mounted on the head and two interceptors are used.

It is important to note that both the mercury-magnetic and photo-electric cut-offs enable the scale to actually weigh material out of the hopper, insuring delivery of the correct amount of material to the process. This arrangement is to be contrasted with equipment in which the material is accurately weighed into the hopper, but where the discharge of material from the hopper is not a weighing operation. Thus, complete delivery of the weighed material to the process may not always take place. With the latter arrangement, it is quite possible for a pocket of material to be weighed time after time, causing each batch to be short by that amount. Where materials are actually weighed out of the hopper, a small amount of material often is purposely allowed to remain in the hopper after each batch as an aid to overcoming flushing conditions.

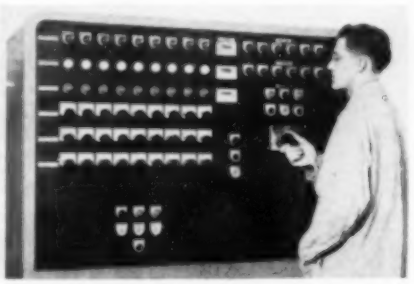


Fig. 8—Toledo's central control panel for automatic weigh-batching system

CENTRALIZED SYSTEMS

With automatic batching systems, a single operator controls the entire batching operation as well as the movement of the batch, from a central control panel of the type illustrated in Fig. 8. This includes the movement of materials from the time they leave the supply bins to their delivery to the process. In this way, complete responsibility for accurately proportioned batches is centralized in a single skilled operator. The centralized automatic batching system decreases both the time and labor required for batching, increases the overall accuracy of batching, and makes possible the elimination of dusty conditions and chances for contaminating the batch.

The following systems are described to illustrate the wide possibilities obtainable with automatic weigh-batching systems.

The only way to defeat the effects of inhomogeneity in glass production is to provide thorough uniformity of materials handling from hour to hour and from day to day. If the various ingredients are permitted to vary even over a narrow range, one day the glass may be filled with batch stones, while the next day it may be filled with seeds and blisters, and perhaps the next day lumpy and cordy glass may be the result. It has been pointed out that the predominant day-to-day fluctuations in glass production are principally dependent on the batch house and its associated weighing equipment.

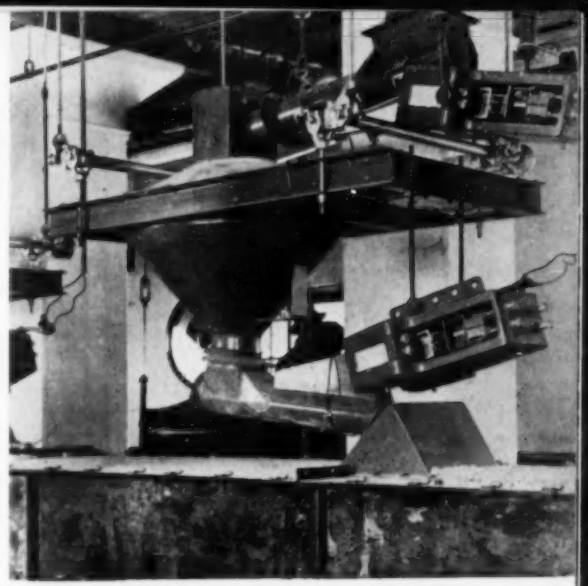


Fig. 9—Automatic suspension hopper scale used in glass batching systems

GLASS BATCHING

Consider a plant with a capacity of 200 tons of glass per day, batching on an 8-hour shift. This represents approximately 90 batches of 5,000 lb. each every 8 hours, or an average of over 11 batches per hour. An automatic batching system should be designed, therefore, to produce at least 12 such batches per hour.

Five major ingredients go into the preparation of the glass, in approxately the following proportions: Sand, 1,500 lb.; soda ash, 550 lb.; dolomite, 500 lb.; feldspar, 140 lb.; cullet, 2,310 lb., totaling 5,000 lb.

The following automatic dial type suspension hopper scales, of the type illustrated in Fig. 9, will handle the above ingredients. For weighing sand, one 2,000-lb. scale with 2-lb. graduations; for weighing soda-ash and dolomite, two 750-lb. scales with 1-lb. graduations; for weighing feldspar, one 250-lb. scale with ¼-lb. graduations; for weighing cullet, one 3,000-lb. scale with 5-lb. graduations.

The ingredients are stored in silos arranged in a line. Materials feed through the scales to a conveyor type gathering belt, which delivers them to a skip hoist, the latter elevating them to a mixer. The mixer is discharged by an operator into batch cans on a monorail. The weigh hoppers are fed and discharged by means of vibrating feeders. The entire batching system is controlled from a central panel. Electrical interlocks are provided to insure the following conditions:

Fig. 11—Scale with large dial and graphic recorder used to proportion Monooil ingredients for TNT production

1. Before the scales will weigh out a batch, the previous batch must be discharged.

2. Before the scales will discharge: (a) all scales must weigh out the desired load, (b) the conveyor belt must be running, and (c) the skip must be in the loading position and must have ascended since the last time the scales discharged.

3. Before the skip will ascend: (a) definite time interval must elapse after the discharge of the last scale, and (b) the mixer must be in the mixing position and must have discharged since the last movement of the skip.

4. Before the mixer will discharge: (a) the batch must be mixed for a definite time, and (b) a batch can must be in position and the previously filled can must be moved.

RUBBER BATCHING

One modern rubber batching installation comprises a total of eight scales and is capable of automatically serving two Banbury mixers. The scales employed include two 500-lb. platform scales with ½-lb. graduations for weighing rubber; two 25-lb. bench scales with 1-oz. graduations for weighing pigments; one 50-lb. suspended hopper scale with 1-oz. graduations for weighing carbon.

Weighing rubber on the platform scales is one of the few manual operations required by the system. Pigments are fed to the scales by means of vibrating feeders. Three conveyors are required, namely: two rubber conveyors, each of which serves a Banbury mixer, and one reversing pigment conveyor, which serves both mixers. Each pigment chute empties into a vibrating feeder and each chute is equipped with a bin level indicator, a vibrator to insure constant flow, and a star feeder or bin check valve to prevent flushing of the materials. Once the scales are adjusted for a series of batches, operation of the system proceeds as follows:

(1) Rubber is placed on the platform scale manually according to compounding pointers, until the total desired weight is satisfied and indicated by a tolerance signal light on the scale. The rubber conveyor will now start when called upon by the Banbury operator.

(2) The Banbury operator presses a start button which sets the rubber conveyor into motion, providing: (a) the Banbury has been previously discharged, (b) the Banbury ram is up, and (c) the Banbury gate is closed. The starting of the conveyor is electrically interlocked with the above functions.

(3) The rubber conveyor runs for a given intervals of time, as determined by a timer, which is set at the time the system is installed. Thus, the rubber is discharged into the Banbury.

(4) The pigment conveyor starts, providing all pigment scales have received the loads for which they are set. The direction in which the pigment conveyor moves is dependent upon the control station from which the starting impulse is received. At the end of a given interval, as determined by another timer, the pigment conveyor stops.

(5) After each pigment scale is discharged, it is automatically refilled, ready for the next batch, providing an automatic counter, set for a given number of batches, does not lock out the system.

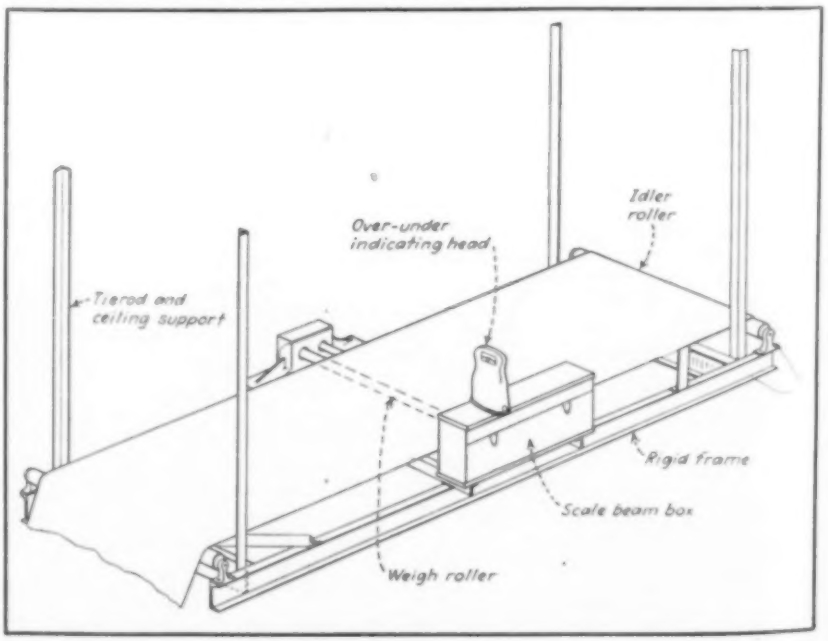
In industries, such as the manufacture of drugs and pharmaceuticals, batching is the basis of the entire operation. Although batching efficiency, which is a direct result of automatic batching systems, is desired, time savings are sacrified in favor of extreme accuracy and precision. For most industrial products, the automatic systems are entirely satisfactory. In drug manufacture, however, it is mandatory that each weighing be supervised by one or more persons, who generally are registered pharmacists.

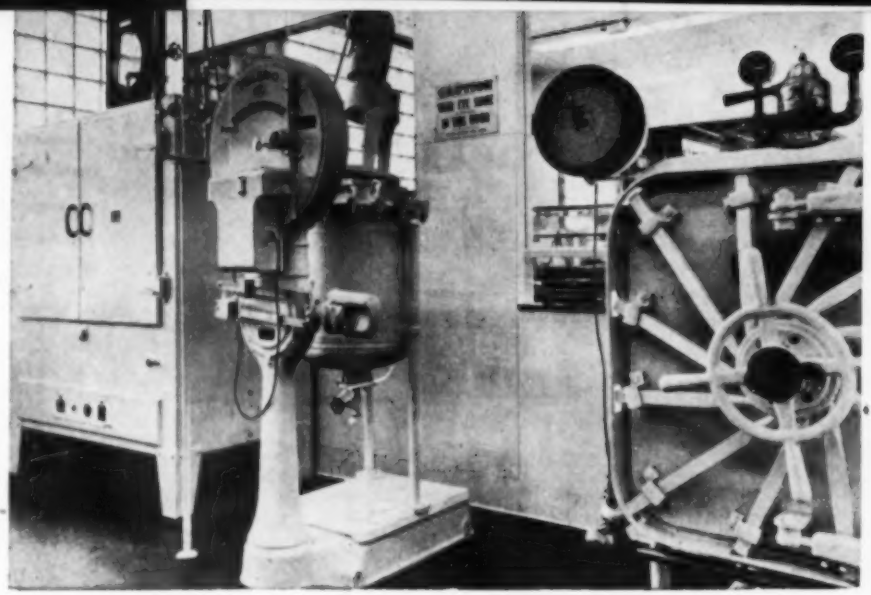
MANUAL BATCHING

Throughout the processing of pharmaceuticals, weight is a major criterion of the control division. The weight of a final batch of material, such as a batch consisting of thousands of tablets, must tally—within extremely close tolerances—the total weight of the various ingredients called for by the formula. To maintain the weight balance under complete control, weighings are made after each major operation and at each point of inter-transfer within the plant. The importance of the final weight balance can best be illustrated by the fact that a large batch of a final product, valued in thousands of dollars, can not be released to the market until any and all deviations from the weight balance are fully investigated and explained to the satisfaction of the control division. Naturally, the management of a pharmaceutical plant desires to keep such investigations to a minimum and has found that frequent step-by-step weighings during the course of manufacture are the best insurance against discrepancies.

For ease in handling quantity and cost calculations, the standard formulas are usually expressed in lbs. and decimal fractions thereof. Most manufacturers consider it good practice to express formulas in one basic unit and never to express part of the formula in lbs. and the remainder in oz. or other units. The convenience and lower

Fig. 12—Moving sheet can be weighed on this Toledo checking scale





Process vessel, mounted on scale, used in manufacture of penicillin

possibility of errors with this system are obvious.

At one time, pharmaceutical manufacturers used volumetric measurements to some extent in the handling of liquids, but modern trends have practically eliminated this practice. Handling of liquids on a weight basis eliminates the use of volumetric units in formulas and has led to a general increased accuracy in compounding and a greater simplicity in handling calculations.

The industry long ago displaced beam type scales in favor of automatic dial scales and the present trend is toward the use of automatic printing scales, which produce neat, clearly printed weight records. Duplicate and sometimes triplicate records of each weighing are required in the drug industry. The value of printing scales for such rigid accounting is immediately evident. These scales accommodate printed forms of various sizes and shapes so that the accounting and control departments can design a form most suitable for their filing systems.

GRAPHIC RECORDING

The preparation of mono-oil for TNT requires accurate proportioning of toulene, sulphuric acid, and nitric acid. These materials are proportioned from overhead suspended weigh tanks, as partially illustrated in Fig. 11. The scales are equipped with mercury-magnetic cut-offs which stop the pumps when the desired weight of material has been withdrawn from the tanks. Note the extra large indicating dials and also the graphic recorder located atop the scale dial housing. These recorders provide permanent records showing the time of weighing and the actual weight of each ingredient. The records are invaluable to the production superintendent when checking operations, especially during the night shift, and also when checking the causes of production difficulties.

Automatic scales may also weigh a continuously moving sheet of material and thus provide a means of checking material density, thickness, gage, etc. If the weight is not within desired tolerances, electric signal contacts are made to warn the operator of an unsatisfactory condition.

The scale illustrated in Fig. 12 consists of: (1) three rollers, supported by a rigid frame and lying in the same horizontal plane, the middle roller being the *live* or weigh roller, (2) scale levers supporting the weigh roller, (3) a scale beam with movable poise for adjusting the scale, (4) an over-under indicating head, and (5) electrical contacts which operate warning signal lights or alarms.

CONTINUOUS CHECKING SCALES

In operation, the moving sheet of flexible material passes over the three rollers. The weight of the material between the two outside idler rollers is divided among the three rollers as follows: $\frac{1}{4}$ of the total weight is supported by each of the idler rollers and $\frac{1}{2}$ is supported by the weigh roller. Thus, if four yd. of material lie between the two outside rollers, the weight of two yd. is supported by the middle roller. Since the middle roller is connected directly to the scale levers, it is the weight of the two middle yd. of material that is indicated by the scale. This condition is true, of course, regardless of whether the material is moving or at rest.

The load represented by the desired weight of the material being weighed is counterbalanced by an appropriate pendulum mechanism connected to the scale levers and equipped with a pointer which moves over a chart and automatically indicates any trends from the predetermined correct weight. The pointer indicates zero only when material of the desired weight is passing over the middle roller. Movement of the indicator is sufficiently great to permit convenient, accurate reading at a distance of from 20 to 30 ft. Where the scale is installed in a relatively dark location, or where the operator's station is a considerable distance from the scale, an illuminated magnifying lens attachment is obtainable.

Tube and tread uniformity in the rubber tire industry are often controlled by means of these scales. This application is illustrated in Fig. 13. Several variables affect the final extruded product, including the operating temperature and pressure of the tuber, speed of the conveyor, adjustments of the die, etc. Weight per running foot of the extruded product is one reliable index of proper extruder or tuber operation. A continuous indication of the weight enables the operator to maintain the equipment in proper adjustment. Automatic temperature controls on the tuber, of course, tend to iron out variations and permit adjustments to be made more quickly.

Scales of this type are used widely in the sheeting of plastic materials and in the rubber and plastic coating of fabrics and paper.

When specifying a scale for weighing and feeding bulk solid materials, the following physical characteristics of the materials should be considered. Then, the weighing and feeding equipment should be evaluated in light of its ability to successfully cope with these characteristics.

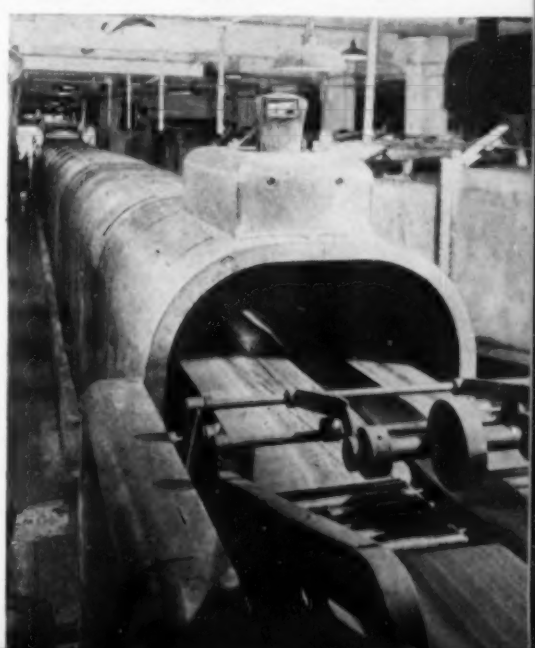
MATERIALS HANDLING

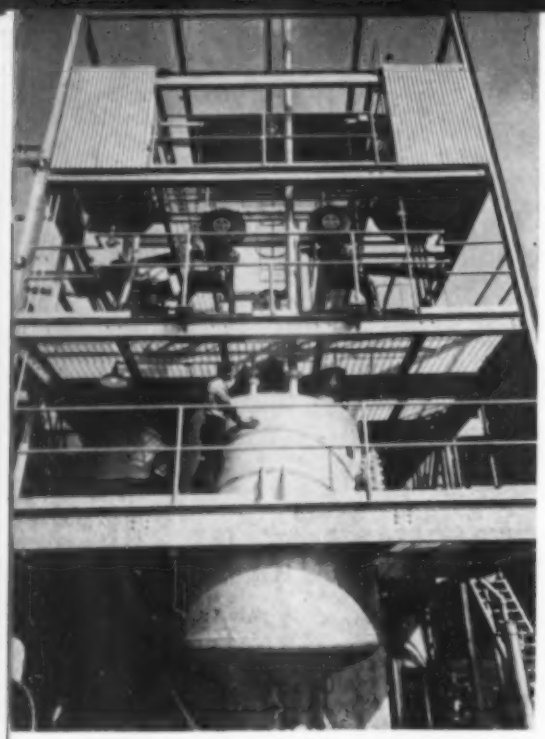
Arching—Many materials commonly handled in processing, such as lampblack, activated carbon, zinc oxide, titanium oxide, fine soda-ash, and hydrated lime, tend to arch when placed in hoppers.

Arching is best overcome by keeping the individual solid particles continually in motion. This condition can be accomplished by rigidly fixing an electric vibrator to the side of the hopper. These devices operate at a frequency of 3,600 vibrations per minute and with an approximate amplitude of $\frac{1}{32}$ in.

In addition to preventing arching, bin vibrators eliminate air pockets and voids in the hopper that may form when the hopper is filled and also tend to assure a greater

Fig. 13—Built-in scale for continuous weighing tire tubing from the tuber





Liquid components of synthetic rubber are weighed in this installation

homogeneity of the material discharging from the hopper gate. Very few materials are crushed or pulverized so well that all particles are of equal size. In the absence of hopper vibration, the smaller particles and fines tend to segregate and roughly collect in a center cone, while the larger particles roll to the side. Consequently, when the hopper is discharged, the fines will drop out first, while the larger particles will be discharged later. A properly vibrated hopper many help to distribute particles uniformly throughout the hopper. Although an automatic weigh feeder will recognize these changes in particle weights as the material is discharged from the hopper, it is logical that performance of the feeding operation will be improved by ironing out variables of this sort.

Flushing—Closely related to arching is the tendency of materials to flush. This condition is caused by the sudden breaking of an arch or otherwise clogged state. Materials may flow from a hopper satisfactorily even though there may be partial clogging or arching. However, when this condition is relieved suddenly, the material literally gushes forth and floods the feeder or scale.

In many cases, flushing may be prevented by a bin vibrator which eliminates tendencies to clog. This is especially true in connection with light, fluffy materials which flow freely and which are difficult to hold back under any circumstances.

Weigh-batching into tank cars

USEFUL DEVICES

Sectional check valves, which permit only a small portion of material to be discharged from a hopper at any given time, are frequently used to alleviate a flushing condition. The rotary bin check valve (Jeffrey-Mfg. Co.) illustrated in Fig. 10 comprises a conical hopper which is flanged for direct fastening to the bin bottom. An agitator which rotates on a vertical rotor shaft prevents arching within this conical hopper and with most materials its effect is transmitted for some distance into the storage bin, especially if the bin is also conical. The driven agitator cuts the bottom of the column of material preventing formation of an arch and hence permits the material to flow into the opening. From this opening, the material is swept horizontally 180 degrees by an eight-bladed rotor and is dropped into the valve discharge chute. In practice, a vibrating feeder, usually equipped with a vibrating hopper, is located beneath the discharge chute and a motor control in the chute stops and starts the valve to keep a constant supply of material ahead in the feeder.

Some supply hoppers are equipped with air pipes which run along three sides of the lower part of the bin. An occasional puff of air through these lines aids in causing sluggish materials to flow smoothly. Air is applied only when needed, since a continuous flow of air into the bin would cause excessive dusting and loss of material.

Moisture Content—The percentage of moisture in a material to be weighed is important from two standpoints, namely: (1) the presence of moisture affects the texture of the material and, therefore, its handling qualities, since moist materials tend to cling together and usually require vibration to render them free flowing, and (2) materials with varying moisture content often are used in processing operations. In the latter case, it must be stressed that the feeder recognizes only weight and, if part of the weight of the material is due to moisture, less useable material may be fed to a process than is desired. Where extremely critical, frequent moisture determinations should be made and the feeding rate adjusted accordingly.

Density and Uniformity—This condition is a major factor in determining the capacity, belt or hopper size, and accuracy of a scale or feeder. It is immediately evident that a smaller hopper or feeding belt can be used for handling a given quantity of relatively dense material than would be required for a much lighter material. Some idea of the variation in the density of materials commonly handled in scales and feeders can be gathered from the accompanying table. When selecting a feeder or scale, the engineer always should be specific as regards the material density.

Where relatively impure substances are being fed to a process, the variation in percentages of the components in the substance must be considered carefully. If there is a variation of 10 percent in the content of critical material in the feed, the weighing accuracy on that critical material should not exceed 10 percent. The accuracy of the feeder or scale cannot make up for variations in quality of the raw material.

Dust and Toxic Characteristics—Most weigh feeders are available with totally enclosed hoods, designed especially for dusty and toxic materials. Unless specified, however, this equipment normally will not be supplied by the scale manufacturer.

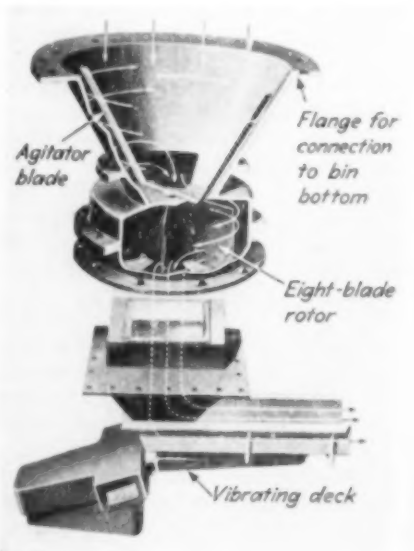
Temperature—Materials can be handled in many types of weigh feeders up to temperatures of 2,000 deg. F. Hot substances, of course, affect the materials of construction used and, therefore, the average operating and limiting temperatures to be encountered should be specified.

COST CONTROL

As with the control of other major variables, such as temperature, pressure, pH, etc., affecting chemical processes, weight control properly applied is a tool for decreasing costs, increasing production, and improving product quality.

The cost control department of a plant

Fig. 10— Rotary bin check valve



Density of Various Materials

Material	Density Lb. per Cu. Ft.
Cork, ground	4 to 5
Charcoal, ground	10
Wheat, middlings	20
Cocoa shells	30
Cinders, ashes, and clinker	40
Salt, coarse	45 to 52
Sulphur, ground (200 mesh)	50 to 55
Soda ash, dense	60 to 62
Calcium, carbide, loose	77 to 80
Cement, portland	94
Fluorspar, ground (100 mesh)	90 to 100
Sand, wet	105 to 110
Iron ore	125 to 150

is responsible for keeping costs down and for making certain that full value is received for all expenditures, including those for materials, labor, and a host of overhead factors. First of all, it is necessary that every lb. and oz. of raw materials paid for are actually received at the plant. Secondly, it is necessary that each lb. of material received is converted to useable finished products and that, where waste occurs, such waste be accounted for. The sources and extent of waste must be determined so that steps can be taken to improve efficiency. Scales and flow meters are the major tools for collecting cost data regarding the flow of materials through a plant.

RECEIVING

Where an organization spends thousands of dollars annually to support a cost control department, it is absolutely essential that this department use only accredited data. Certified receiving weights make up a part of these data and are one basis upon which plant efficiency is determined. Therefore, great care should be exercised in selecting scales for the receiving department. Several scales with overlapping ranges should be selected so that the percentage of accuracy in weighing is consistent. A high standard of weighing to one part in one-thousand parts is a good standard to adopt.

Blind acceptance of railroad or shippers' weights by the receiving department of a plant is considered poor practice because of various factors. (1) Ever present possibility of unintentional errors on the part of the railroad or shipper. (2) The condition of the railroad's or shipper's scales may not be up to par. Adjustments or repairs may be required, or the accuracy of these scales may not be in keeping with the high standards maintained by the plant receiving the material. (3) Losses through pilferage, leakage, etc. may occur between the point of shipment and the point of receipt. (4) Departments questioned of production inefficiency may claim shortages in starting ingredients as the cause of such inefficiency and, without accurate receiving weights, no proof can be offered against such claims.

Cost of weighing all materials received may be considered prohibitive by management. In such cases, a percentage of all shipments should be checked and the remainder of a shipment judged on the basis of the sample selected. A knowledge of the past performance and frequency of errors made by the railroad or shipper will aid in determining the percentage for sampling.

Accounting of high cost raw materials is extremely important. The importance of accurate accounting of relatively low cost materials, however, cannot be overemphasized. On a percentage basis, there is a definite fallacy in the idea that accounting of cheap materials is not so important as the accounting of more expensive items. This is true because, generally, the lower cost materials are usually used in much larger quantities.

USE ACCURATE SCALES

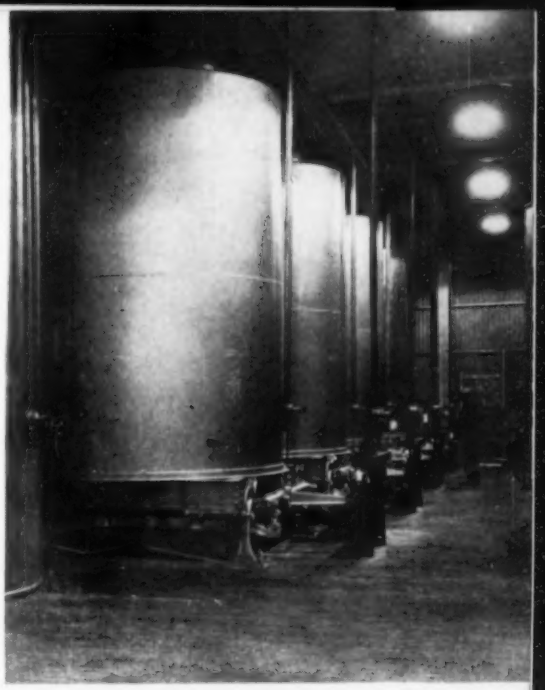
For example, assume that 20 percent of a manufacturer's material costs are for material A, costing $0.05 per lb.; and that 2 percent of his material costs are for material B, costing $1.00 per lb. Assume that these materials are used in the following daily quantities:

10,000 lbs. of A at $0.05 per lb. = $500.00
50 lbs. of B at 1.00 per lb. = 50.00

Now assume that material A is accounted for to an accuracy of 2 percent, meaning that a daily shortage of 0.02 × 10,000, or 200 lbs., with a value of $10, will be tolerated. However, realizing the high cost of material B, management requires that this material be weighed to an accuracy of ½ percent. There will be a tolerable daily shortage of this material of 0.005 × 50, or 0.25 lbs., with a value of $0.25.

Obviously, when weighing in materials, the total value received must be considered primarily, rather than the unit price. It does not make sense to use cheap scales to weigh cheap materials.

The scales in the receiving department vary, of course, with the quantity and nature of materials received. A pharmaceutical manufacturer, for example, may require:



Battery of large weigh-tanks for solvents used in the chemical industry

(1) an analytical balance, with a capacity of 200 g. to weigh extremely small recepits of special concentrates or intermediates, (2) a bench scale with a capacity up to 200 lbs. for weighing canisters, small cartons and packages, (3) a floor scale with a capacity up to 6,500 lbs. for weighing bags, barrels, and drums, (4) a built-in scale with a capacity up to 21,500 lbs. for weighing baled drugs, (5) a railroad track scale with a capacity up to 200 tons for weighing tank cars of alcohol, solvents and other bulk materials, and (6) an automatic hopper scale for receiving coal.

Speed and convenience of weighing are very important in the receiving department. By selecting scales which reduce the time and labor required for weighing, the costs per weighing are reduced, enabling the receiving department to substantially increase the number of items checked daily. Automatic dial scales with large indicating dials should be selected to provide a maximum

Scales used in manufacture of cosmetics

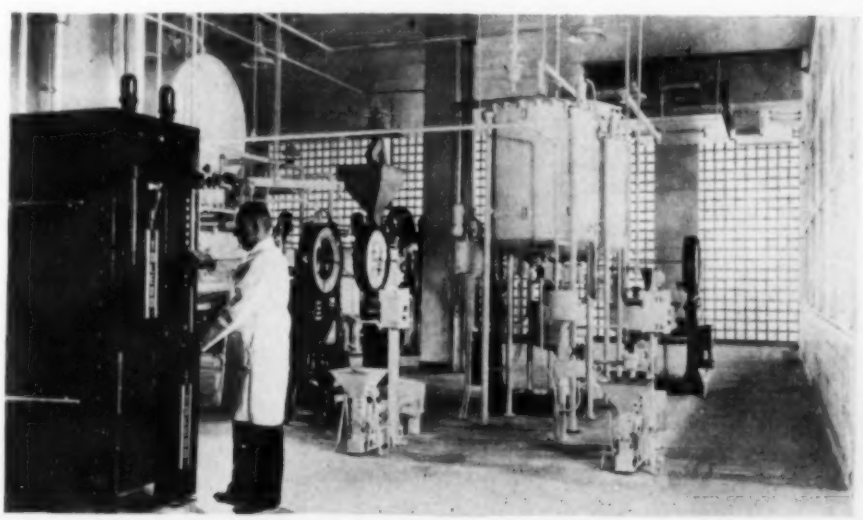


Fig. 14—Totalizing conveyor scale employed in weighing bulk tobacco

Fig. 15—Even-arm scale used for checking cartons of drug products

in reading accuracy and convenience. Beam scales are slow and no longer considered consistent with modern accounting practice, unless equipped with attachments for immediately indicating the weight. The manipulation of poises and the mental calculations required to operate a conventional beam scale are frequent sources of error and impatience on the part of the operator. In many cases, a dial scale with a printing attachment will prove economical because of the increase in weighing efficiency resulting. These scales produce accurate printed records and the time required to make such a record is no greater than that required to simply read the dial manually.

Time also can be saved by incorporating the receiving scale in a continuous conveyor line. Bench scales suitable for weighing in bags, boxes, cartons, and the like are particularly adaptable to roller conveyor lines. A set of rollers is mounted directly on the scale platform so that no lifting is required to place the container on the scale.

Where bulk materials, such as lime, crushed stone, wood chips, tobacco, and the like, are received, a totalizing conveyor scale of the type illustrated in Fig. 14, can be installed directly in a conveyor line. The material is weighed continuously without slowing up the receiving operation. Automatic hopper scales generally are used for weighing coal, although totalizing conveyor scales are also adapted to this application.

PACKAGING

Weight control is important in packaging operations, (1) to meet legal requirements insofar as the weight of material in the package must equal or exceed that marked on the package, (2) to insure customer satisfaction and trust, since these are soon lost when inaccuracies occur, and (3) to prevent shipment of materials in excess of that required, since it is easy to package profits unless close control over this operation is exercised.

A small even-arm scale, as illustrated in Fig. 15, often is used in packing and checking filled packages. A package of the correct weight is placed on one pan and the packages to be checked are placed on the other pan. An over-under indicating chart indicates how much the package deviates from the standard. Scales of this type have been equipped with automatic electrical signals so that blind operators can perform this operation.

An automatic scale with six separate weigh hoppers and discharge spouts for packaging small quantities is illustrated in Fig. 16. This unit is fully automatic and continuous, requiring no manual positioning of the containers under the filling spouts. Completely automatic operation is effected by accurately coordinating the action of the conveyor with the scale. The machine illustrated is capable of delivering one-half, one, and two lb. quantities and is suitable for filling cartons, jars, or tins. The machine has a capacity of sixty containers per min. with very close weight tolerances. The conveyor carries a vibrating settler to insure proper packing of the materials. Another weigh packer capable of delivering single drafts, varying from 2 oz. to 20 lb., at a rate from 5 to 10 per min. is illustrated in Fig. 17. This unit incorporates a photo-electric cut-off and vibrating feed.

Automatic scales have been greatly responsible for the reduction of packing costs and the increase of packing speed in the chemical industries.

Weighing of carbide is illustrated in Fig. 18. The material is fed from a suspension type weigh hopper through a slanting chute by means of a vibrating feeder. The scales are equipped with mercury-magnetic cut-offs so that only the desired amount of material for each drum is fed to the weigh hopper for each cycle. Note that the drums are placed on shaking platforms to insure thorough packing of the material. The operator controls the flow of material through a clam shell type valve so that the material will not overflow the drum before it is properly shaken down. The operator calls for a fresh draft of material when an empty drum is set in place, merely by depressing a push button.

Weighing and bagging of tetrasodium pyrophosphate is shown in Fig. 19. The material is fed from the supply hopper located over the scale. One operator, watching the pointer on the scale dial, controls the manuel valve at the bottom of the hopper. Once filled to the proper weight, the bag is quickly transferred to the other operator who sews it.

PROCESS ACCOUNTING

Scales are used frequently for directly checking and recording the consumption of materials by a process. In bleaching, sewage and water treatment, for example, the consumption of chlorine is checked in this manner. In many cases, a chlorinator is used to feed the chlorine to the process. One convenient and accurate check on the operation of the chlorinator comprises weighing the chlorine drums. These weights should be checked several times daily and preferably a continuous record maintained. In addition to checking the operation of the chlorinator and providing valuable cost accounting information, these weight records indicate to the operator when the cylinders must be replaced.

Generally, the chlorine cylinders are

Fig. 20—Floor scale with recorder for weighing chlorine drums

placed on large floor scales although in small plants, portable platform scales may be employed. In Fig. 20 is illustrated a floor scale for weighing large cylinders of chlorine. Note the continuous recording instrument placed atop the scale head.

Space does not permit full coverage of the use of scales in cost accounting. Suffice it to say that many of the process industries depend largely upon scales for controlling inventories, scheduling production, paying wages, shipping final products, etc.

IMPORTANCE TO ACCOUNTING

Scales which produce automatically printed weight records practically eliminate the human element as a source of weighing errors. The development of automatic dial scales eliminated the need for manual manipulation of poises and the necessary mental calculations on the part of the operator. Even with the standard automatic dial scale, however, the operator is required to record the readings. Manually recorded weight records are subject to (1) carelessness and indifference on the part of the operator, and (2) dishonesty.

Carelessness and indifference are apt to become prevalent where units of approximately the same weight, such as encountered in receiving and shipping operations, are weighed consistently day in and day out. The factor of dishonesty may be encountered wherever the scale operator can gain directly through short- or over-weights, or indirectly by cooperating with other individuals, dividing the gains from dishonest weights. For example, where materials are delivered to a plant, the operator may feasibly cooperate with the vendor by reporting more materials received than are actually delivered; or where wage payments are based upon the weight of material produced, the scale operator may cooperate with the wage earner by indicating more materials produced than are actually made. While in most cases, it may be assumed that the scale operator is honest, progressive manufacturers prefer printed weight records and thus eliminate all doubts regarding this factor. At the same time, printed weight records protect the operator from being falsely accused of dishonesty.

In addition to these factors, printing scales possess the following advantages: (1) neat, legible, uniform records are produced for use by the accounting department, (2) reliance is placed in printed weight tickets by seller, manufacturer, and buyer alike, (3) weighing time is reduced, since the operator need not take pencil and paper in hand. Where labor and management are both vitally concerned with a given weight, as for example, the weight of material mined, produced, etc., acceptance of an accurate automatic printing scale has frequently eliminated the need for two operators at the scale to check and recheck weighings. Some labor management contracts specify that scales of this type be used for measuring production and that wages be paid on the basis of printed weight records.

In selecting a scale, it is first necessary to determine the capacity, size, and style most suited for the job. Once these factors are established, the field of available scales should be judged from the standpoint of excellence in design and construction. The rates of depreciation and obsolescence of scales are usually less than those for most other items of process equipment and, therefore, scale selection should not be made on a basis of small difference in first cost.

SELECTING SCALES

Capacity—Automatic dial scales generally are graduated from zero to the total dial capacity, in 1,000 graduations, or approximately that number depending upon the most convenient subdivisions to use for the range involved. For example, a scale with a dial capacity of 1,000 lbs. will have 1-lb. graduations. With this arrangement, at full capacity, the scale will weigh to one part in one-thousand parts, although the scale actually can be read accurately to the half-graduation, meaning that it will weigh to one part in two-thousand parts.

It is important to note that maximum accuracy percentagewise, is obtained at the top of the dial capacity. For example, a 1,000 lb. load on a 1,000 lb. capacity scale will be weighed with an accuracy of 1 part in 1,000. An 800-lb. load on the same scale will be weighed with an accuracy of 1 part in 800. In other words, no matter what load is on the scale, the scale will weigh to the closest lb., or by reading half graduations, to the closest ½ lb. Obviously, then, for a load of 400 lbs., a 1,000 lb. capacity

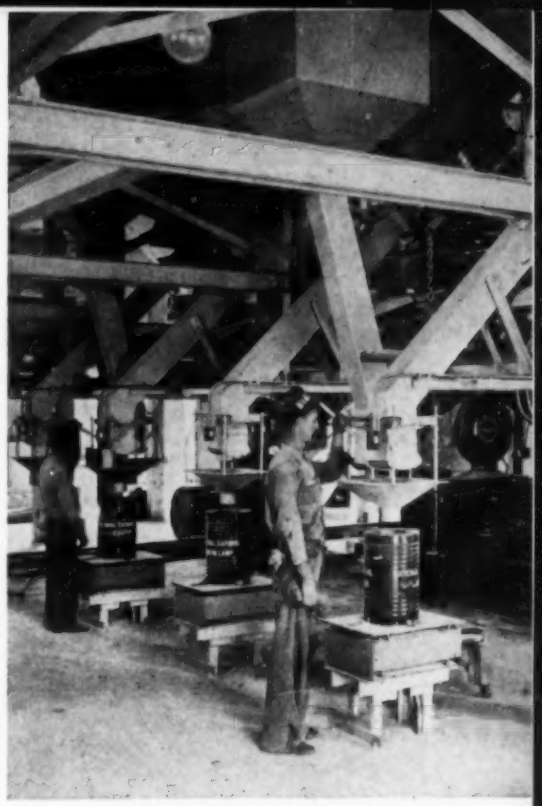


Fig. 18—Multiple scale (suspended hopper) installation for packing carbide

Fig. 16—Hoepner multiple unit weigh-packer available from Consolidated Packaging Machinery Corp.

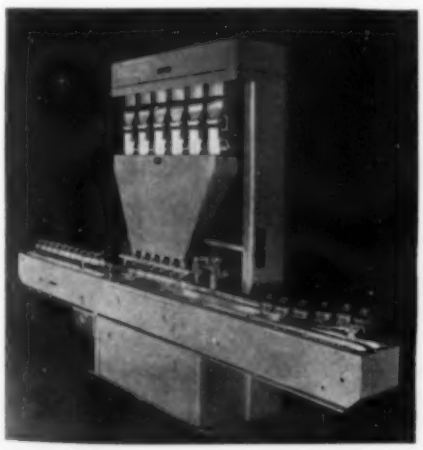


Fig. 17—Single unit weigh-packer which utilizes an even-arm fan scale

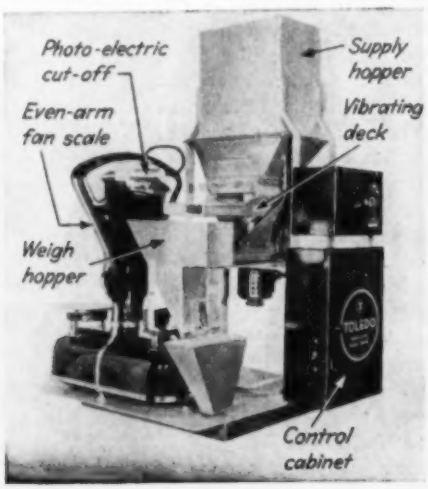
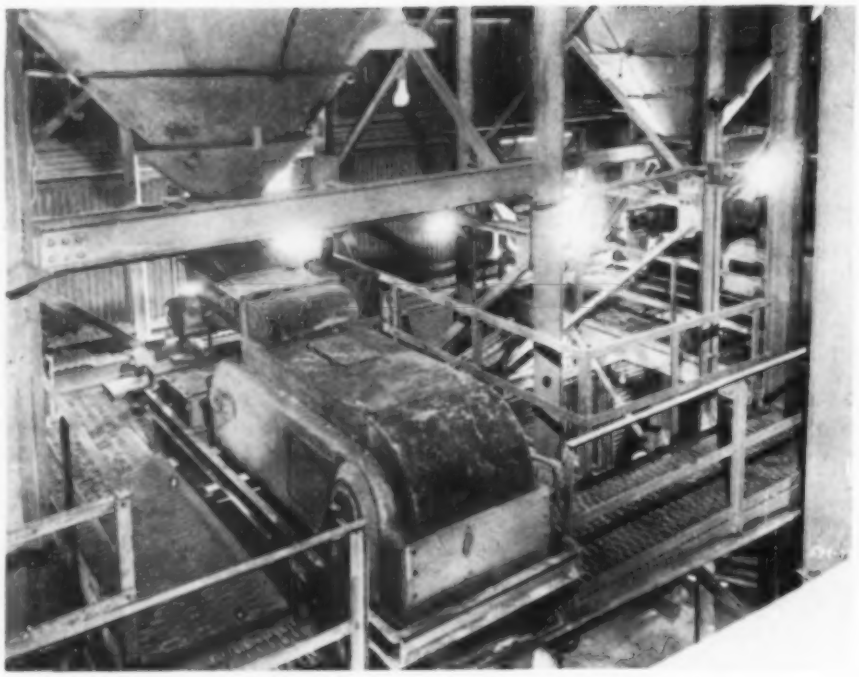


Fig. 19—Weigh-packing tetrasodium pyrophosphate in bags for shipment



Dust-tight pivoted belt feeder used in potash production

scale will not provide the accuracy afforded by a scale with a 500-lb. capacity. On a 1,000 lb. capacity scale, a 400 lb. load will be weighed to one part in 400, while on a 500 lb. capacity scale, the load will be weighed to one part in 800. Thus, it is seen that the capacity of a scale should be selected with reference to the average load to be weighed on it.

Where a variety of items is to be weighed, some thought should be given as to whether one scale will do the job, or whether two or more scales will be required. The items to be weighed during an average day should be tabulated and analyzed and a decision made based on these data.

Size—In connection with floor, built-in, truck, and railroad track scales, the following factors should be considered when selecting the platform size: (1) What is the base size of the average container or vehicle to be weighed? (2) what is the base size of the largest container or vehicle to be weighed? (3) How many containers will be weighed at any one time? (4) What floor space is conveniently available for installation of the scale.

Style—Some factors which should be considered in selecting the style of a scale include: (1) If a streamlined accounting system is desired, specify a printing scale. (2) If the scale dial is to be read from a considerable distance, specify a large, illuminated dial. (3) If it will be convenient to read the scale dial from either of two directions, front and back, specify double indication. (4) If a permanent record of weighings is required, specify graphic recording. (5) If materials must be weighed continuously, specify: (a) totalizing conveyor scale, or (b) an automatic hopper scale. (6) If a totalizing conveyor scale or automatic hopper scale is desired, specify totalizing counters so that maximum usage of the scale as an accounting machine will be obtained.

LOCATION

The importance of proper installation to scale operation can not be overemphasized. A mediocre scale, properly installed and maintained, will give better results than a good scale poorly installed and given no maintenance. But mediocre results can not be tolerated in modern processing where profits are intimately tied in with weighing accuracy. Proper installation is an investment in weighing accuracy.

Selection of a proper location for a portable scale will be governed principally by the factor of convenience. Often the most convenient location can be determined only through experience. These scales readily lend themselves to moving, portability being one of the major factors in their design. Often it is more convenient to take the scale to the load rather than vice versa. Where scales are moved frequently, several small spaces should be set aside in the plant specifically for storage of the scale when not in use. These spaces should be sufficiently out of the path of vehicles and traffic to prevent possible damage to the scale.

Much more careful consideration must be devoted to selecting a site for a permanently installed scale. The problem should be given the same consideration as would be given to the installation of a large machine tool or piece of process equipment. These scales become a part of the production line of the plant and should be positioned so that the weighing operation will be in proper sequence with the other processing operations. Decisions as to the location of the scale should not be the sole responsibility of the scale mechanic, but should be the result of a careful study by the production planning department.

From purely the standpoint of scale operation, the following factors should be considered:

(1) Locate the scale where it will be easily accessible, but not directly in the path of vehicles which do not require weighing. The scale should bear only the traffic which is brought to it for weighing.

(2) Select a location where air currents will not bear on the platform, causing inaccurate readings. This factor is especially important where large platforms are involved and where a scale is located between two floors of a plant. A breeze of five miles per hour velocity exerts a pressure of 0.12 pounds per square foot. If directed at a truck scale platform (40 feet by 10 feet), with an area of 400 square feet, the breeze will exert a pressure of 48 pounds. Such a pressure causes a false reading. If a naturally sheltered location can not be found, a shelter to protect the scale from drafts should be constructed.

(3) Select a floor or road area where the approaches to the scale platform will be level for several feet. While inclines to and from the scale platform are acceptable, the immediate approaches should be level and smooth to avoid bumping each time a vehicle is driven on or off the scale. Care in this respect will eliminate unnecessary horizontal and vertical impacts and hence will reduce the maintenance required.

(4) Except in special cases, a railroad track scale should not be located where the number of cars to be weighed does not exceed 60 percent of the total number of cars.

(5) Locate the scale dial so that it will be easy to read. In dark locations, provide illumination to aid reading.

REFERENCES

Benton, W. A., Weighing in the Chemical Industries, *J. of S. C. I.*, Aug. 26, 1927, pp. 764-7.

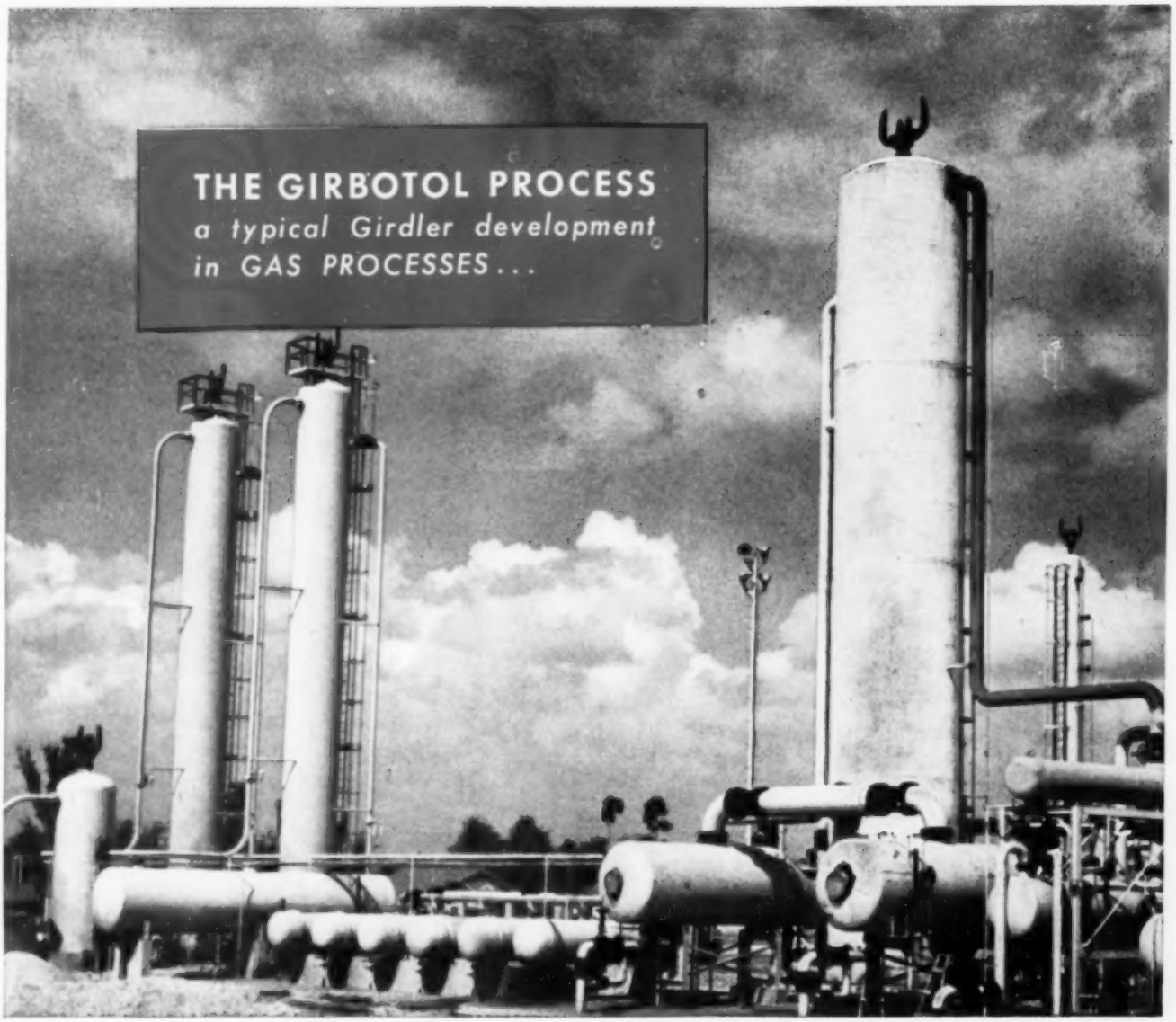
Ghering, L. G., Refined Method of Control of Cordiness and Workability of Glass During Production, *J. of Am. Cer. Soc.*, Dec. 1944, pp. 373-87.

Johnson, S. H., Weighing in Bulk, *Industrial Management*, Dec. 27, 1923, pp. 366-70.

Measurement and Control of Process Variables, *Chem. & Met. Eng.*, May 1943, pp. 115-6.

Pooley, F. H., Some Notes on Weighing and Weighing Machines, *J. of S. C. I.*, Nov. 29, 1929, pp. 1152-6.

Smith, R. W., Testing of Weighing Equipment, Nat. Bur. of Stds. Handbook H37, Jan. 31, 1945.



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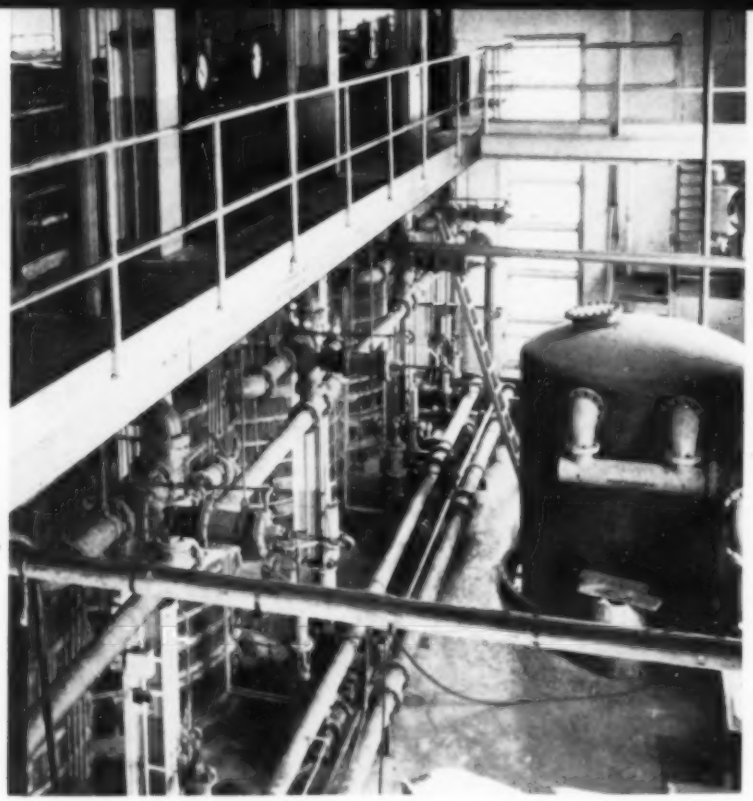


1 Over a million gallons per day of Delaware River water are demineralized by the cation-anion exchange process in this gravity flow plant; the top of the vacuum degasifier column is shown at right

A *Chem & Met* PICTURED FLOWSHEET

SYNTHETIC BEAD CATALYST

PRODUCTION of synthetic bead catalyst by the Socony Vacuum Oil Co., Inc., Paulsboro, N. J., did much to prevent the wartime aviation gasoline program from bogging down at a most critical time. Guided only by laboratory data, and without benefit of pilot plant experience, this plant was built and operating within six months after ground was broken.

Basic raw materials include sodium silicate, sulphuric acid, aluminum trihydrate, and demineralized water. Fluid chemicals are received by barge and pumped to storage tanks, while dry chemicals are received by rail. River water is purified to remove various catalyst poisons.

Manufacturing the bead catalyst consists of several steps: (1) Preparing the raw materials into the two gel forming solutions; (2) continuously blending the two solutions in correct proportions to form separate drops of gel, each of which becomes a bead after further treatment; (3) wet heat-treating, base exchanging with aluminum sulphate, and washing the raw beads; (4) drying the processed wet beads; (5) final drying, followed by tempering the dried beads at elevated temperatures; (6) screening, bulk storage, packaging and shipping.

Gel forming solutions consist of acid-alum and sodium silicate. Aluminum sulphate is prepared from aluminum trihydrate and sulphuric acid then diluted with water to form the base exchange solution. Sulphuric acid is added to this to obtain the acid-alum solution used in gelation. Sodium silicate solution is prepared by diluting "N" brand silicate of soda with treated water. The two forming solutions are metered to the mixing head on each forming tower. Here they are mixed to form a liquid hydrogel which emerges from the nozzle and distributes evenly over a fluted cone dividing into a large number of individual streams. These streams flow directly into a layer of oil, where they break into droplets forming beads.

Freshly formed beads are sluiced from the bottom of the forming towers into a flume leading to the wet processing tanks. Here the processing takes place in three stages, namely, hot water treating, base exchanging and final washing. Hot water treatment sets the structure and controls the density of the finished beads. Base exchanging removes the zeolitic sodium present in the raw beads, replacing it with aluminum. Final washing removes sodium sulphate and other soluble salts. Hot water treating takes place in a closed system while washing and base exchanging consist of a multistage, countercurrent operation.

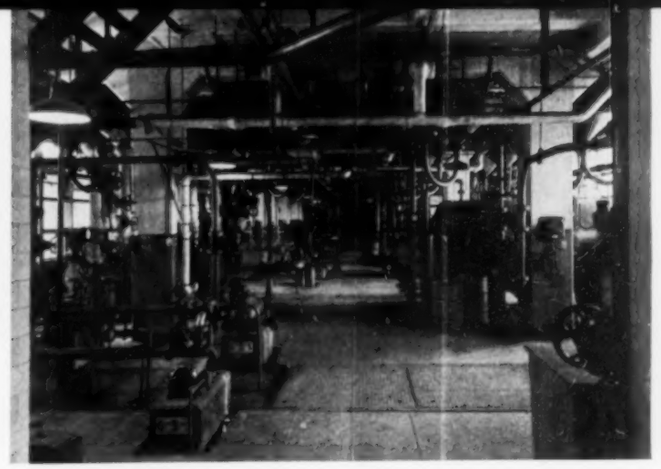
Completely processed beads are sluiced to the dryers where the beads are dewatered and dried to 10 percent moisture. Then they pass to the tempering kiln where final drying takes place and where they are held for a soaking period at high temperature to relieve the stresses caused by the drying operation. This imparts ruggedness and good wearing quality to the finished catalyst. Tempered beads are then transferred to the screen house atop the storage silos where the fines are screened out. After storage the beads are weigh-packaged into moistureproof, multiwall bags for shipment. For a more detailed account of this complete process turn to pages 94 to 98.

CHEMICAL & METALLURGICAL ENGINEERING

April, 1946

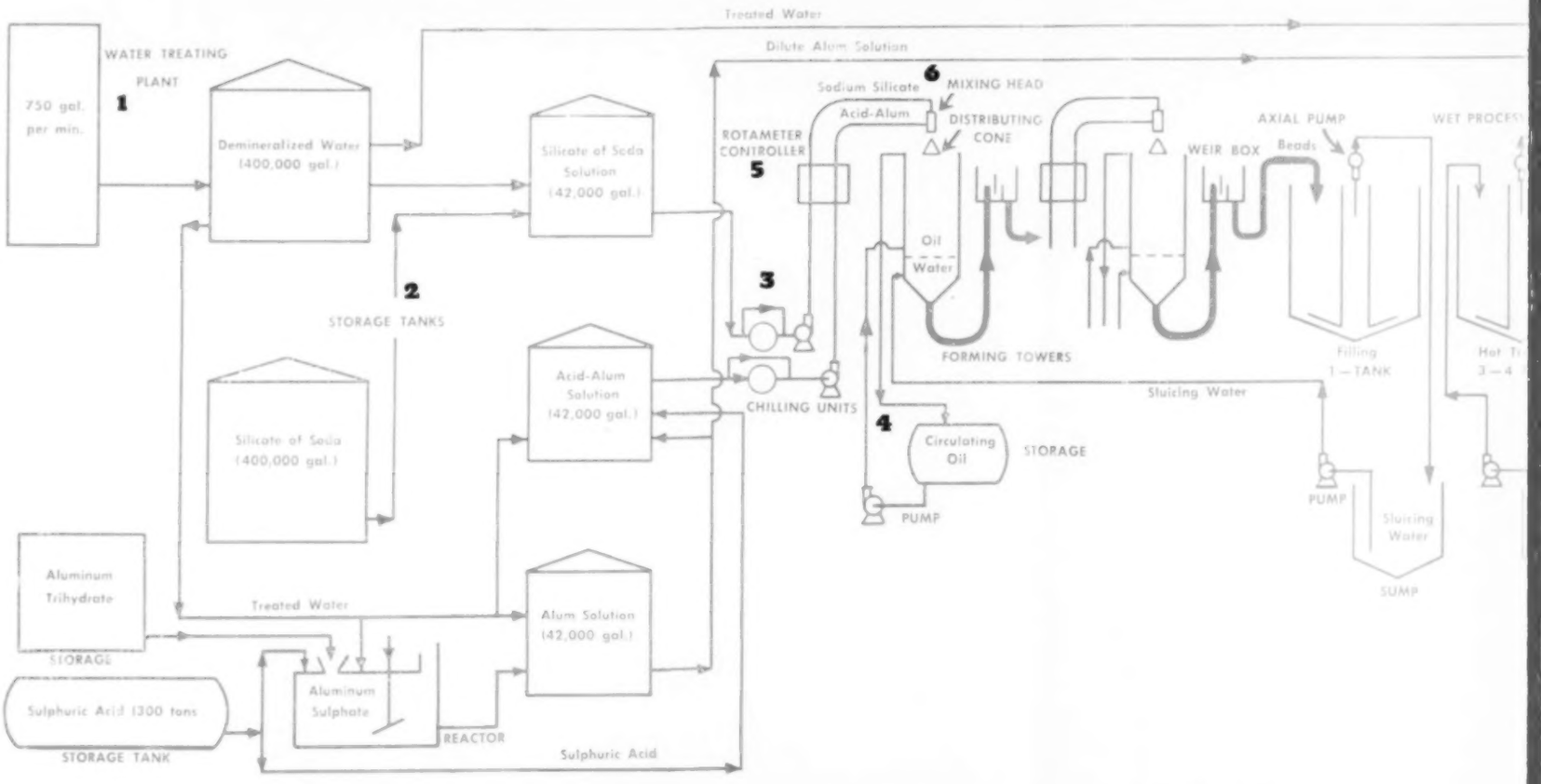
PAGES 138 TO 141

2 Tile-insulated storage tanks keep dilute aqueous solutions from freezing; alum tanks are lead lined while all are equipped wtih eductor mixers



4 Corrosion resistant pumps handle the forming solutions and process liquors; many corroded parts were replaced with Lucite

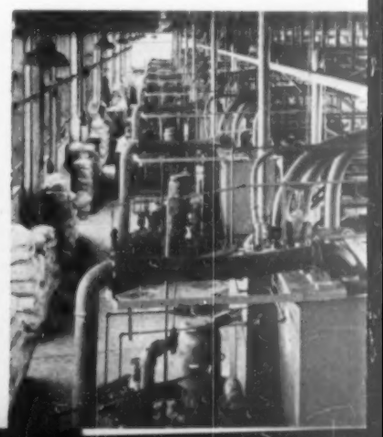
6 Resin coated
smaller streams w



3 Under certain conditions this steam jet unit is used to refrigerate the forming solutions; piping hookup permits unit to be bypassed

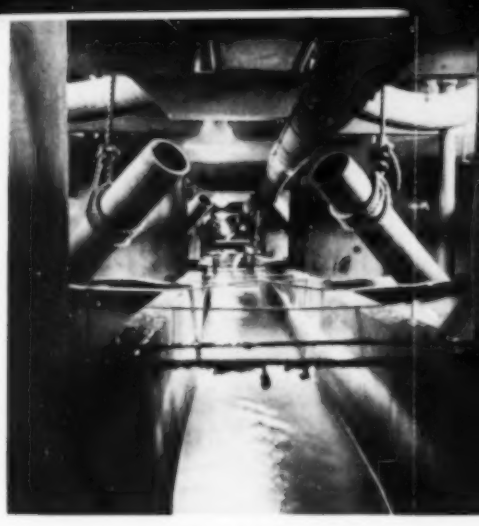
5 Electronic rotameter controllers maintain the flow of forming solutions within 0.5 percent

7 Operating floor above wet process
lead pipe and equipment are used to

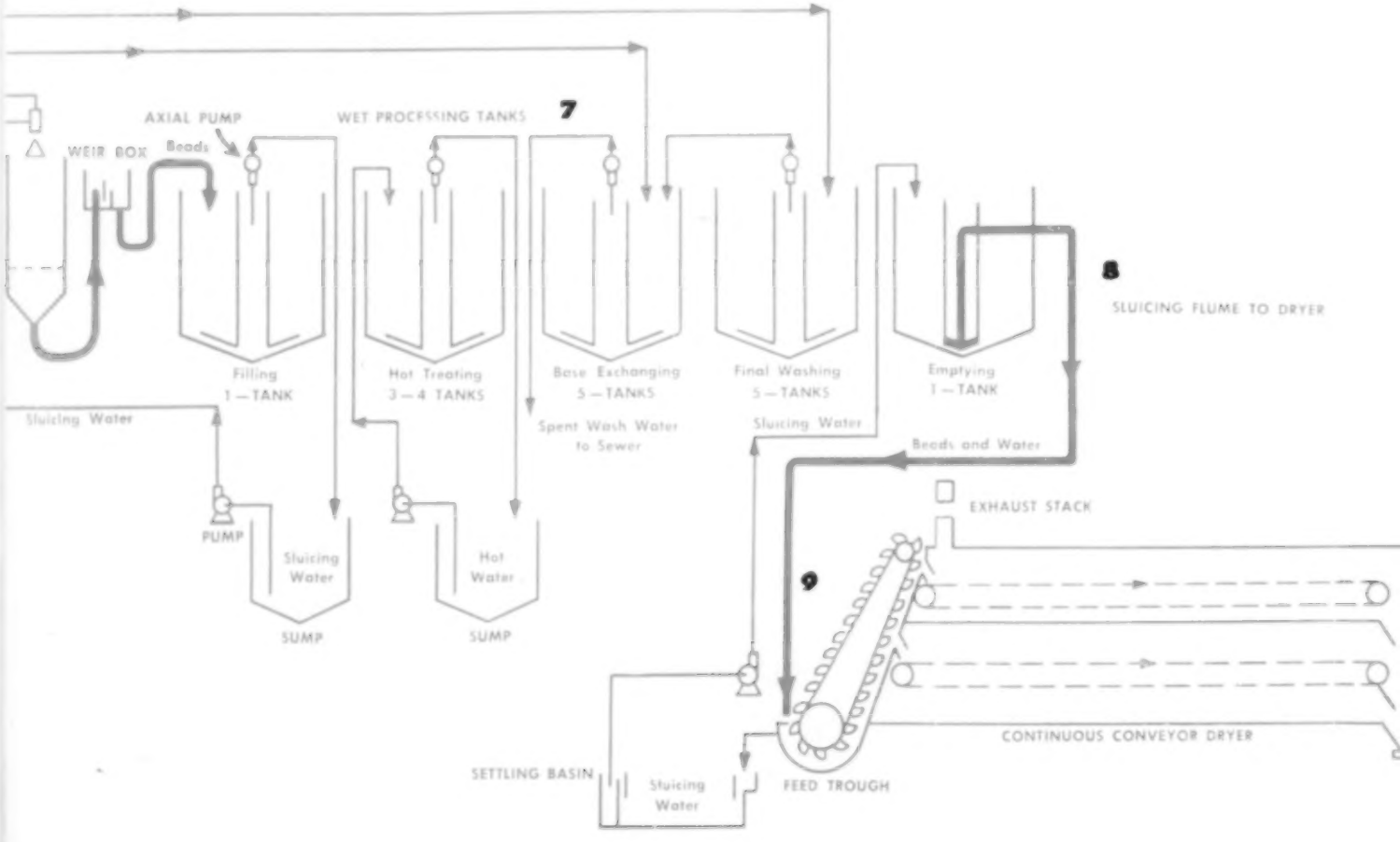


rming solutions and replaced with Lucite

6 Resin coated plaster of paris cones divide liquid hydrogel into smaller streams which form beads while falling through the oil



8 Wax coated steel flumes transfer beads; raised or lowered to stop or start flow, elimin



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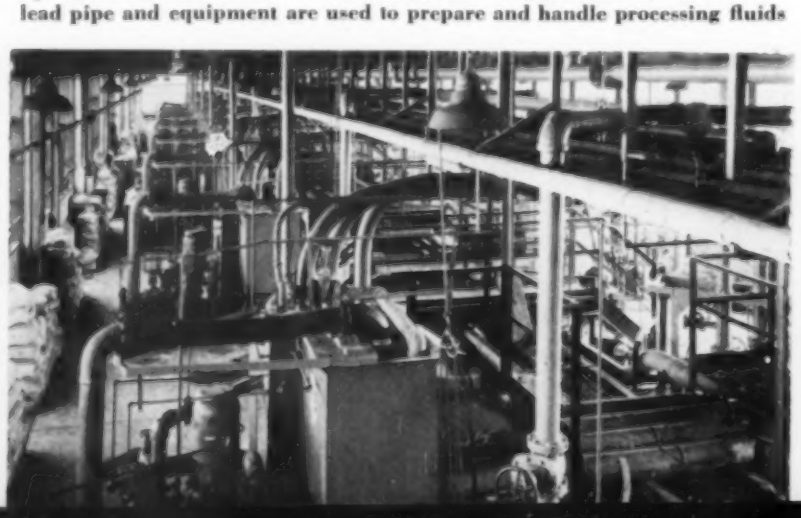
7 Operating floor above wet processing tanks; approximately 125 tons of lead pipe and equipment are used to prepare and handle processing fluids

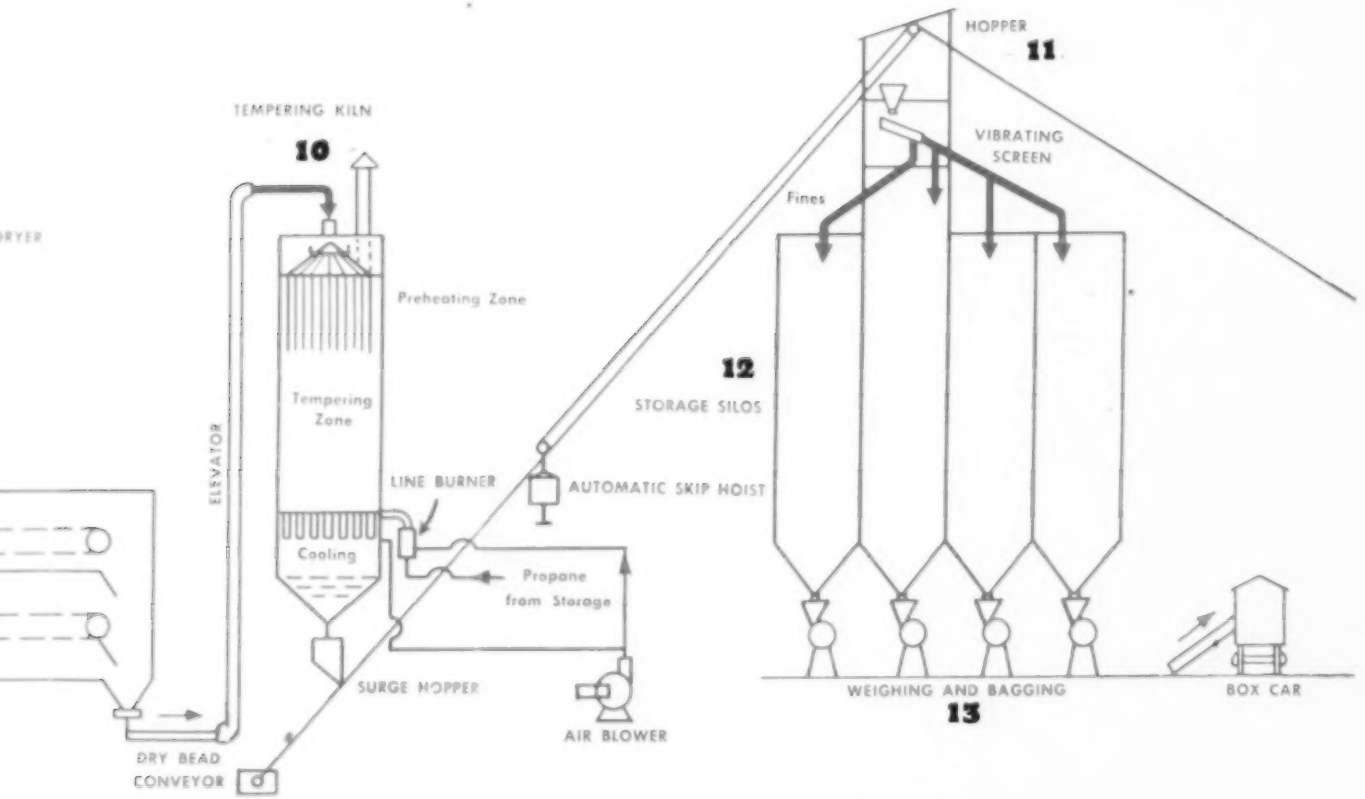
9 Wet beads are dewatered before drying in 100 pe atmosphere at 280 deg. F.; beads shrink to 1/11 o



sfer beads; rubber hoses are flow, eliminating many valves

10 Heat treating in kiln relieves internal stresses to improve bead quality

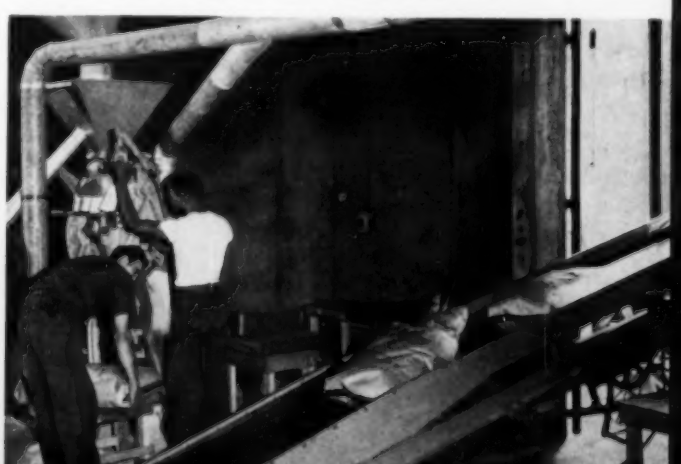
11 Fines and broken beads, less than 5 percent of total production, are screened out



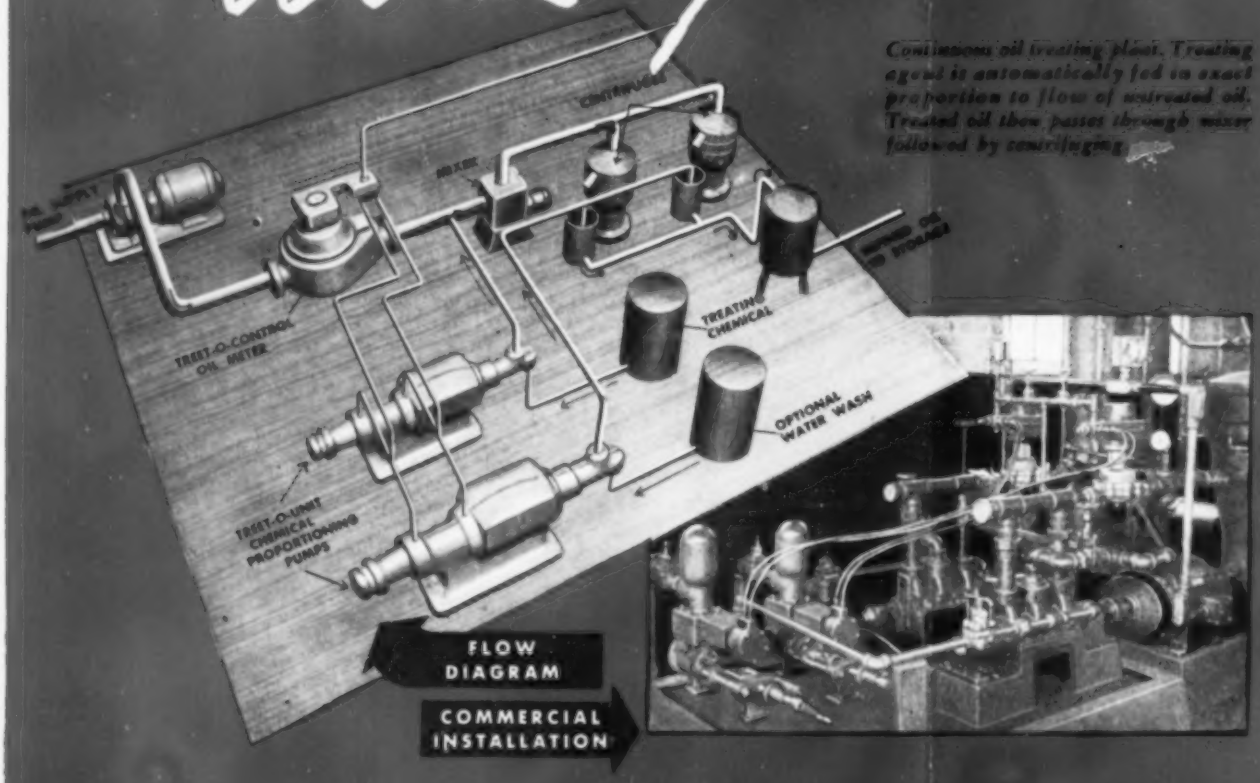
in 100 percent steam to 1/11 original size

12 Silos hold 650 tons of beads, 200 of fines; note skip hoist, at upper right

13 Beads are filled, weighed into multiwall, moistureproof bags and loaded into box cars



A *Working* PRINCIPLE



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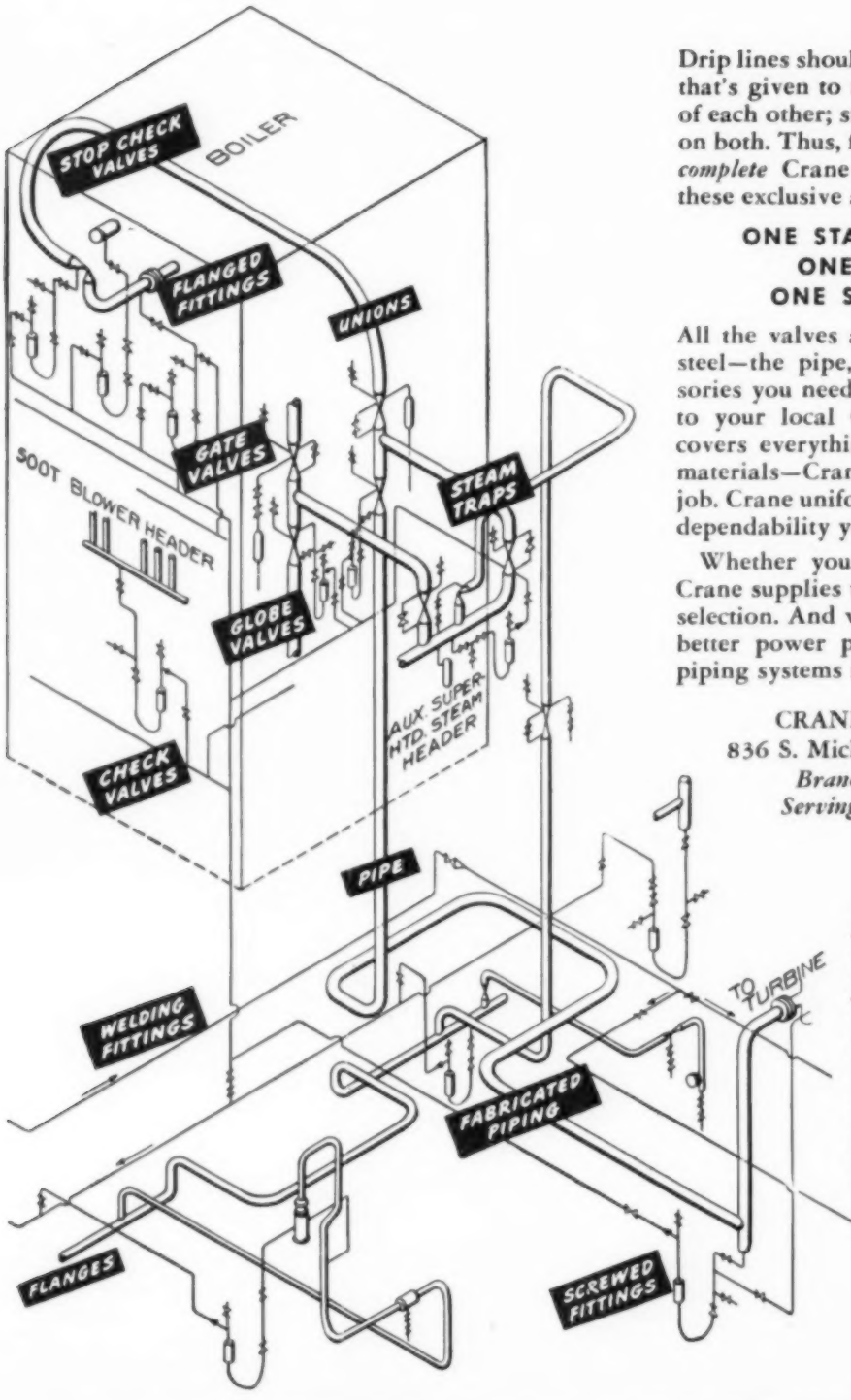

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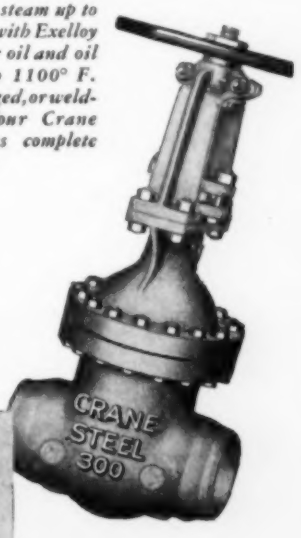

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NEW PRODUCTS AND MATERIALS

R. W. PORTER, Assistant Editor

TEFLON

DEVELOPED during the war by E. I. du Pont de Nemours & Co., Wilmington, Del., a new plastic material, tetrafluoroethylene resin, under the brand name of Teflon was used exclusively for military purposes. Teflon is characterized by high strength and resistance properties since it retains its strength and form at higher temperatures than any other known organic material. It resists the action of such reagents as aqua regia chlorosulfonic acid, acetyl chloride, boron trifluoride, hot sulphuric acid, hot nitric acid and boiling solutions of sodium hydroxide.

Its high heat resistance is shown by the fact that when subjected to a temperature of 572 deg. F. for three months, it showed no degradation. It retained all its useful properties at that temperature. It is not adversely affected by temperatures as low as —75 deg. F. Applications of this new plastic will include uses where high resistance to solvents and corrosive agents is required, where heat endurance is of importance and where high frequency electrical insulation is needed. It has been used in jet engines, being the only plastic that will stand up under such high temperatures. It is expected to find wide use in gasket material for high temperatures, tubing and piping for chemical plants, distillation equipment for acids, etc.

Teflon's dielectric qualities make it desirable for conduits which are subject to attack by corrosive materials and also may be used as the basis for coaxial cables, conducting high frequency current for radio, radar and television.

Various articles of Teflon

CRYSTALLINE SODIUM PENICILLIN

COMMERCIAL production of sodium penicillin in crystalline form has been announced by the Commercial Solvents Corp., 17 East 42nd Street, New York, N. Y. Special crystallization in the final production stage of the penicillin salt has made possible the production of the crystalline product, which has high potency and is heat stable. Refrigeration during storage and shipping is thus eliminated. The potency of the crystalline drug is of the order of 1,400 to 1,500 units per mg. and will be available in single vials of 100,000, 200,000 or 500,000 units. It is white in color and under a microscope the crystals are visible.

Because of the increased purity, dosages as high as 200,000 units have been possible as against dosages of 50,000 to 60,000 units with the former amorphous preparation. Within a few weeks this company's plant will be making crystalline penicillin exclusively.

ORGANIC PEROXIDE

AN undesirable impurity in petroleum consisting of organic peroxide may now be extracted from petroleum in pure form according to the Union Oil Company of California, Wilmington, Calif. The new petroleum peroxide marketed under the brand name of Uniperox has a close relation to hydrogen peroxide since it can be regarded as an hydrogen peroxide in which one of the hydrogen atoms has been replaced by a hydrocarbon radical. Uniperox is a clear liquid, slightly soluble in water but completely miscible with most organic solvents, petroleum products and resin monomers. The oxygen content of different grades various between 7.5 and 12 percent. It can be kept over a year without appreciable decomposition. Uniperox is a good polymerization catalyst in the manufacture of vinyl type plastics, polystyrene, acrylates, GR-S rubber and for the curing of such special resin monomers as Bakelite BRS 16631, Plaskon 911, Laminac 4122-R, Thalid X-530 and Paraplex P-10. Its activity and ready miscibility with resin monomers makes it suitable in the manufacture of low pressure laminates and castings. Another application of Uniperox is its use as an ignition and combustion accelerator for diesel fuels. The addition of 0.5 percent of Uniperox to low grade fuel not only raises the cetane number but improves cold-starting. This accelerating effect on combustion is explained by the decomposition of Uniperox into chemically active radicals which set off a rapid chain reaction leading to ignition and combustion. The material is also expected to find use as a germicide, fungicide and insecticide.

CONTENTS

WEATHERPROOF GLUE

FORMED by combining the byproduct materials, soybean meal and corn gluten, with a special preparation of water soluble phenolic resin, a new type weatherproof and waterproof glue has been recently announced. It is claimed to be 30 percent cheaper and to have superior binding strength and was developed by the U. S. Department of Agriculture, Northern Regional Research Laboratory, Peoria, Ill. In all tests, the glue stood up under outdoor weather conditions longer than the pieces of plywood which it bonded. It has been successfully tested on a commercial basis for making plywood. Plywood made with this glue passed the 3-hr. boiling test with surplus strength, and in addition the glue line was not attacked by mold. Known as Norelite, this glue is expected to find wide use in the plywood industry when soybean meal and corn gluten become more plentiful.

TETRAPHENYL TIN

SAMPLES of a new chemical compound developed by the Hooker Electrochemical Company, Niagara Falls, N. Y. are now available. Tetraphenyl tin, whose formula is $(C_6H_5)_4Sn$, is an almost odorless, white to light tan, crystalline, free-flowing powder with good thermal stability. Its melting point is 220 deg. C. and its boiling point is 424 deg. C. Decomposition at the boiling point occurs very slowly. It is soluble in

ethyl alcohol, insoluble in water. Among suggested uses and applications are as an HCl scavenger for use with stabilizers in chlorinated compounds, as a preservative for mineral oils and as a reagent in chemical synthesis. Some of the properties are given in the accompanying table.

Properties of Tetraphenyl Tin

Synonym	Tetraphenyl stannane
Formula	$(C_6H_5)_4Sn$
Molecular weight	427.1
Chlorine content (typically), ppm.	20 to 30
Acidity as HCl (typically), percent	0.002
Melting point, deg. C.	228 deg. ± 1.5
Boiling point, deg. C.	424
Flash point, deg. C.	232
Fire point, deg. C.	269
Density at room temp., g. per cc.	1.5
lb. per cu. ft.	32
Vapor pressure at 25 deg. C., mm	1×10^{-4}

	Solubility Temp. Deg. C	G per 100 G. Solvent
Acetone	32	0.18
	36	0.22
Benzene	19	0.83
	37	1.37
Butyl propionate	47	0.36
	52	0.49
Carbon tetrachloride	19	0.26
	34	0.40
Ether	24	0.11
	33	0.14
Methanol	25	0.02
Monochlorbenzene	28	0.78
	36	0.99
Naphtha	39	0.08
	50	0.11
Water	..	Insoluble

AEROSOL INSECTICIDE

RECENTLY announced by the Virginia Smelting Co., West Norfolk, Va., a new aerosol insecticide under the brand name of Lethalaire which employs Freon-12 as a dispersing propellent is now available. Active ingredients of this insecticide comprise pyrethrum extract, DDT, methyl aromatic petroleum derivatives and Xylol. It is commercially available in 5- and 30-lb. cylinders with or without the applicator. A special automatic diffuser for permanent installation in rooms is also available.

INJECTION MOLDING POWDER

DEVELOPED for use at temperatures above the heat distortion point of unmodified styrene compounds or of Plexiglas, a thermoplastis injection molding powder is now available in limited quantities from the Rohm & Haas Co., Washington Square, Philadelphia 5, Pa. Known as Plexene M., this new powder is claimed to be superior to ordinary polystyrene in weathering properties and in resistance to chemicals as well as having improved machining qualities. Moldings made of this new material do not show the tendency to the crazing characteristics of many unmodified styrene compounds. Plexene M has a heat distortion temperature (192 deg. F.) considerably higher than that of Plexiglas R (167 deg. F.) and standard polystyrene compounds. Residual strengths are lessened by its good flow characteristics; maximum service temperatures of 194 deg. F. should be satisfactory for Plexene M molding except where extreme dimensional stability is necessary. Moldings show low shrinkage.

Strength characteristics are improved over Plexiglas as well as polystyrene molding powders. Six months exposure and 200 hours of accelerated aging had little affect on the shape, dimensions and color of typical standard samples. Plexene M is odorless and tasteless and practically unaffected by acid, alkalies and dilute alcohol and is resistant to gasoline and commercial inks. It is attacked, however, by organic solvents such as acetone and ethylene dichloride. It has a power factor lower than that of Plexiglas but not as low as unmodified polystyrene. Plexene M is light amber in color and translucent and opaque colors ranging from ivory to black are available. Full scale production is expected in late 1946.

SYNTHETIC HORMONES

CONSISTING of indolebutyric acid and beta naphthoxyacetic acid diluted with distilled water, a synthetic hormone known as Indol is marketed through the Cleveland Hothouse Vegetable Growers Cooperative Association, Cleveland, Ohio. Used to improve the yield of winter-grown tomatoes, grown in hothouses, this chemical mixture is applied to the first blooms on the tomato plants. A single drop of this mixture on a tomato bloom practically insures a "set" of fruit improving the size and shortening the time necessary for ripening. It is claimed that use of this synthetic hormone will increase the spring crop yield by as much as 15 to 25 percent. It is available in 8-oz. bottles, the contents of one bottle being sufficient for one gallon when diluted with distilled water. This is enough to treat 9,000 plants, the average stand on an acre of ground. It sells for $16 per 8-oz. bottle and is only available in limited quantities. It is effective only on plants grown under glass and on the first three clusters of blooms only. No advantage is gained by using the chemical on field-grown plants.

LEATHER CLEANER

ALL KINDS of leather articles may now be effectively cleaned and toned by use of Leather Lather, a new colorless liquid compound developed by the Link Laboratories, 1015 McGee Street, Kansas City 6, Mo. This cleaning agent contains no wax or petroleum derivative and therefore leaves no grease or oil on the surface of the cleaned object. It is claimed to remove stains from leather articles, to restore original color and softness without rubbing or scrubbing. The active ingredient is a polymerization agent which combines with the dirt and soil to effectively clean such leathers as suede and other fine leather articles. It is available in 4- and 16-oz. bottles and in one-gallon jugs. It will be available through chemical, drug and hardware jobbers.

WETTING AGENT

A SULPHATED synthetic ester possessing wetting, softening and rewetting properties has been introduced by the Hart Products Corp., 1440 Broadway, New York, N. Y. Known as Hartex Duofol L this product is a concentrated liquid miscible with water in all proportions, even when cold, whose clear solutions and high surface actions are not affected by hard water, salt, alkali or weak acid. It is claimed to be an outstanding wetting agent at elevated temperatures and is recommended for use in vat or pad dyeing and for other dyeing operations to give greater uniformity of shade. It is said to be effective in producing controlled shrinkage in sanforizing and in obtaining higher slasher speed and greater loom efficiency in rayon warp sizing. Added to printing paste Duofol L improves penetration and gives better fastness to soaping. The wetting back property imparted to fabrics by this material renders the fabric highly absorbent. In addition, it acts as a softening agent, making the product doubly useful in sanforizing operations. It is claimed that concentrations as low as 0.04 percent (about ½ oz. per 100 gal. of solution) have proved most satisfactory for most applications.

ALKYD RESINS

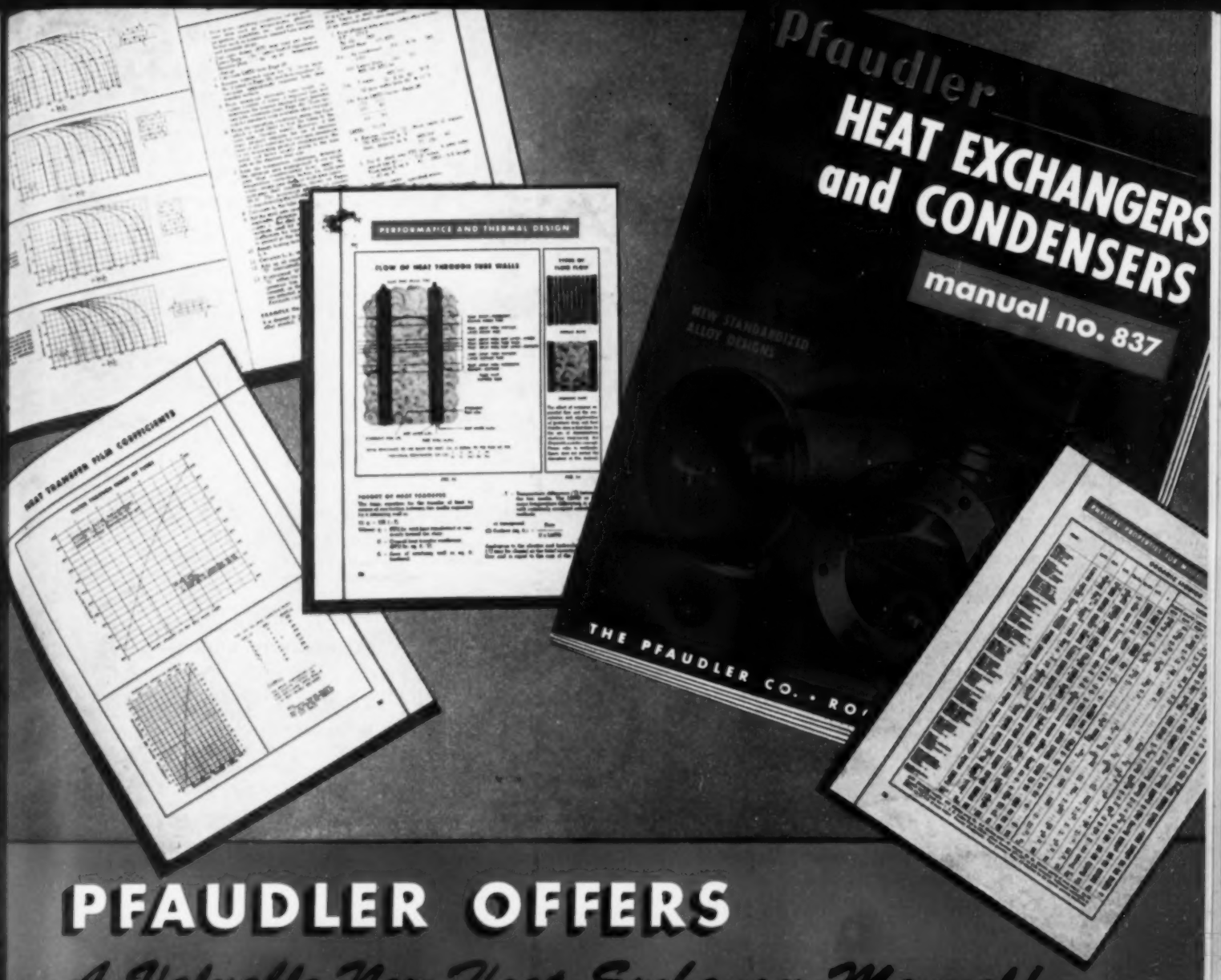
DEVELOPED to replace Aroplaz 1306, a new alkyd type resin, Aroplaz 1314 has been announced by the U. S. Industrial Chemicals, Inc., 60 East 42nd Street, New York 17, N. Y. Aroplaz 1314 contains 12 percent less oil on the solvent-free basis than the resin it replaces, yet exhibits approximately the same qualities. It is suggested for use in architectural and industrial coatings and may be applied by brushing, dipping or spraying. It is a hard resin modified, phthalic-free, oxidizing alkyd-type resin of medium oil length. It air dries to hard tack-free finishes overnight and bakes hard in ¾ to 1 hr. at 250 deg. F. Finishes prepared with this resin have moderately good flexibility and good resistance to water and alkali. It is pale in color and coatings made from Aroplaz 1314 exhibit high color-retentive properties. White enamels made with this new resin approach the whiteness of enamels based on phthalic-alkyd resins. In gloss and gloss retention it is as good in both clear and pigmented films as many similar products. Finishes prepared with Aroplaz 1314, however, have only moderately good exterior durability.

Specification for Aroplaz 1314

Solution: 74–76 percent solids in mineral spirits	
Acid number (solvent free basis)	9–13
Color (G.H. 1933)	8–10
Weight per gal. at 25 deg. C., lb.	7.9–8.0
Oil content (solvent free basis), percent	54
Phthalic anhydride content	None
Solubility: Complete in petroleum and coal-tar solvents; insoluble in ethyl alcohol. Compatible with many oils, resins and alkyds.	

PARAFFIN HYDROCARBON

DISCOVERED by the Houdry Process Corp., 225 South 15th St., Philadelphia, Pa., a new paraffin hydrocarbon with the empirical formula $C_{16}H_{34}$ has been recently announced. Given the name of Houdrane, this new hydrocarbon is a highly branched hexadecane having about as many carbon atoms in its branches as it has in the main chain. Its structure is not definitely established, but its properties are different than any of the other known possible isomeric hexadecanes. Up until now the best known hexadecane is the normal hydrocarbon or cetane. Houdrane shows appreciable differences in its properties from cetane and it is noted that whereas cetane solidifies at +18.1 deg.



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- Physical properties for miscellaneous compounds
- Installation, operation and maintenance practices
- Advantages and limitations of various types of heat exchangers.

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ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

C., Houdrane remains liquid to a much lower temperature and solidifies to a glass at about —78 deg. C. A comparison of the physical properties of these two paraffins is given in the accompanying table.

Comparison of the Properties of Cetane and Houdrane

(Formula = $C_{15}H_{34}$; Mol. Weight = 226.44)

Properties		Cetane	Houdrane
Melting pt., deg. C.		+18.1	glass @ −78
Boiling pt., deg. C.			
At 760 mm.		287.5	250.7
100 mm.		208.5	172
50 mm.		188.5	150
10 mm.		147	107.5
D 0/4 deg.		solid	0.7985
D 20/4 deg.		0.7750	0.7854
dD/dt		−0.00069	−0.00065
nD/20 deg.		1.4352	1.4399
dn/dt		−0.00044	
Dispersion		76	76
Sp. dispersion		99	100 ± 2
Sp. ref. L.L.		0.3368	0.3355
n − d/2		1.0477	1.0472
Kinematic viscosity in centistokes	0 deg. C.		8.65
	20 deg. C.	4.43	4.95
	35 deg. C.	3.15	3.46
	55 deg. C.	2.22	2.42
Absolute μ viscosity in centipoises	20 deg. C.	3.43	3.90
	0 deg. C.		10.83

WATERPROOF FABRIC

DEVELOPED by the Chemical Products Division, of the Goodyear Tire & Rubber Co., Akron, Ohio, a new fabric is said to be mothproof, waterproof, scar-proof and scuff-proof. It is woven from a new thread made from Pliofilm which has heretofore been produced in the form of sheets or film. A Pliofilm fiber is now produced which can be twisted into a thread and then woven into a fabric. The thread can be made in a variety of weights to make possible a wide variety of finished fabrics. The Pliofilm thread made from rubber and hydrogen chloride, forms a tough, elastic, flexible film that is readily sealed and is waterproof. It can be produced in any color and by providing threads of various colors a number of patterns may be obtainable. It is expected that wide applications of this new fabric will find use in making slip-covers for automobiles, airplanes, etc., as well as for luggage, brief cases and on any applications where waterproof and durability are important. Pliofilm fabric will not be placed on the market until natural rubber is again freely available.

ANION EXCHANGE RESIN

AN IMPROVED acid adsorbent or ion exchange resin claimed to have wide usefulness in the fields of water conditioning and in numerous applications calling for the removal or recovery of acid has been announced by Resinous Products & Chemical Co., Philadelphia, Pa. Known as Amberlite IR-4B, and closely related to Amberlite IR-4, its operational characteristics are said to be superior. The new exchanger exhibits an increased rate of exchange, thus permitting higher flow rates during operation. Also it can be regenerated at higher rates than those recommended for Amberlite IR-4 and for certain applications can be regenerated by strong alkalies such as caustic soda. Other advantages include absence from objectionable color-throwing, lower rinse requirements and reduced pack-

ortho-Nitrobiphenyl plasticizer

1 available

2 low cost

3 general purpose

PHYSICAL AND CHEMICAL PROPERTIES

(From Typical Analyses)

MOLECULAR WEIGHT	199.20
MELTING POINT	APPROX. 35°C. (Supercools Readily)
BOILING POINT AT 10 MM.	APPROX. 172°C.
BOILING POINT AT 760 MM.	APPROX. 330°C.
REFRACTIVE INDEX AT 25°C.*	APPROX. 1.613
SPECIFIC GRAVITY AT 40° 15.5°C.	APPROX. 1.189
VISCOSITY AT 25°C.*	38 CENTIPOISES
VISCOSITY AT 45°C.	12 CENTIPOISES
WEIGHT/GALLON	APPROX. 9.9 LBS.
FLASH POINT	143°C. (289.5°F.)
FIRE POINT	179°C. (354.5°F.)

*Obtained on supercooled material.

SOLUBILITY: Practically insoluble in water (either hot or cold). Readily soluble in—

Benzene	Ethyl Acetate	Mineral Spirits
Ethyl Alcohol	Amyl Acetate	Pine Oil
Methyl Alcohol	Ortho-Dichlorobenzene	Turpentine
Ether	Carbon Tetrachloride	Linseed Oil
Acetone	Perchlorethylene	Soya Bean Oil
Methyl Ethyl Ketone	Glacial Acetic Acid	Corn Oil

TOXICITY: For information, write for technical bulletin O-D-700.

Due to its wide range of compatibility, Monsanto ortho-Nitrobiphenyl finds many uses in most types of lacquer and plastic compositions. It can be used alone, or with other plasticizers—and is applicable to the entire range of synthetic resins, from the cellulose esters and ethers through the vinyls and vinyl copolymers. It is compatible with alkyds and some synthetic rubbers.

The low cost of ortho-Nitrobiphenyl—6 cents a pound, in carload lots—is additionally in favor of this all-round plasticizer. It is suggested that you consider its use as:

(1) A camphor substitute in cellulose nitrate compositions

(2) A plasticizer in thermoplastic molding compositions

(3) A plasticizer in lacquer-type coatings to improve water, acid and alkali resistance

(4) A stabilizer with some plasticizing action in varnishes

Other uses may present themselves when you study the table of physical and chemical properties included here. For example, ortho-Nitrobiphenyl may impart fungicidal properties to the compositions of which it becomes a part.

Samples and technical information will be sent promptly on request. Contact the nearest Monsanto Office, forward the coupon to: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Cincinnati, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO CHEMICALS

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MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1700 South Second Street, St. Louis 4, Missouri

Please send, without cost or obligation, samples of ortho-Nitrobiphenyl, technical.

*Name*_____

*Company*_____

*Street*_____

*City*_____ *Zone*_____ *State*_____

YOU CAN INCREASE LIFE EXPECTANCY OF ANTI-FRICTION BEARINGS

While manufacturers and users of all types of machinery base operating cost figures on a definite period of time, over which they can safely predict that their equipment will operate, they fully realize the economy that will result from increasing the "life expectancy" of bearings. Ball and Roller Bearings represent a sizable investment. In order to secure a paying return on the investment, considerable care must be exercised in installation and in lubrication. Manufacturers and users of anti-friction bearings have been able to increase the life expectancy of their bearings by the use of LUBRIPLATE Lubricants. There is a reason for this phenomena. Through long and careful research, the manufacturers of LUBRIPLATE have been able to combine all those desirable qualities that are vital to the continuous operation of anti-friction bearings.

LUBRIPLATE Lubricants stay put when applied. They don't drip away nor are they dissipated at high temperatures. LUBRIPLATE maintains an extra protective lubricating film on bearing surfaces at all times and prevents them from scoring. Since LUBRIPLATE sheds water, it provides that necessary protection against the destructive forces of rust and corrosion. A comparatively small amount of LUBRIPLATE does the job—making it economical as well as long lasting. A durable LUBRIPLATE "film" keeps metal surfaces apart, no matter how heavy the load nor how high the speed, and reduces heat and friction, the exponents of wear, to a minimum. Bearings thus retain their newness longer.

Specially developed to meet the operating requirements of anti-friction bearings, BALL BEARING LUBRIPLATE provides cool and quiet performance for grease type bearings operating at speeds up to 5000 R.P.M. and temperatures to 300° F. For conditions other than above, consult the LUBRIPLATE recommendation chart. Write for a copy of the "LUBRIPLATE SERVICE HANDBOOK" containing valuable information on the subject of lubrication of anti-friction and other bearings. Adv.

ing. It has outstanding resistance to the leaching action of water and solvents and has a wide range of usefulness in deacidification processes where absence of contaminants in treated product is essential. It resists the aggressive action of formaldehyde and formic acid as well as a variety of chemical reagents and solvents. It is available in commercial quantities. Amberlite IR-4B has the following physical characteristics:

Properties of Amberlite IR-4B

Density, lb. per cu. ft.	32 to 36
Percent moisture	40 to 50
Screen grading; mesh	20 to 50
Effective Size; mm	0.4 to 0.6
Uniformity coefficient	Less than 2.0
Solubility	Insoluble in all common solvents
Color	Amber

ALUMINUM FOIL LAMINATE

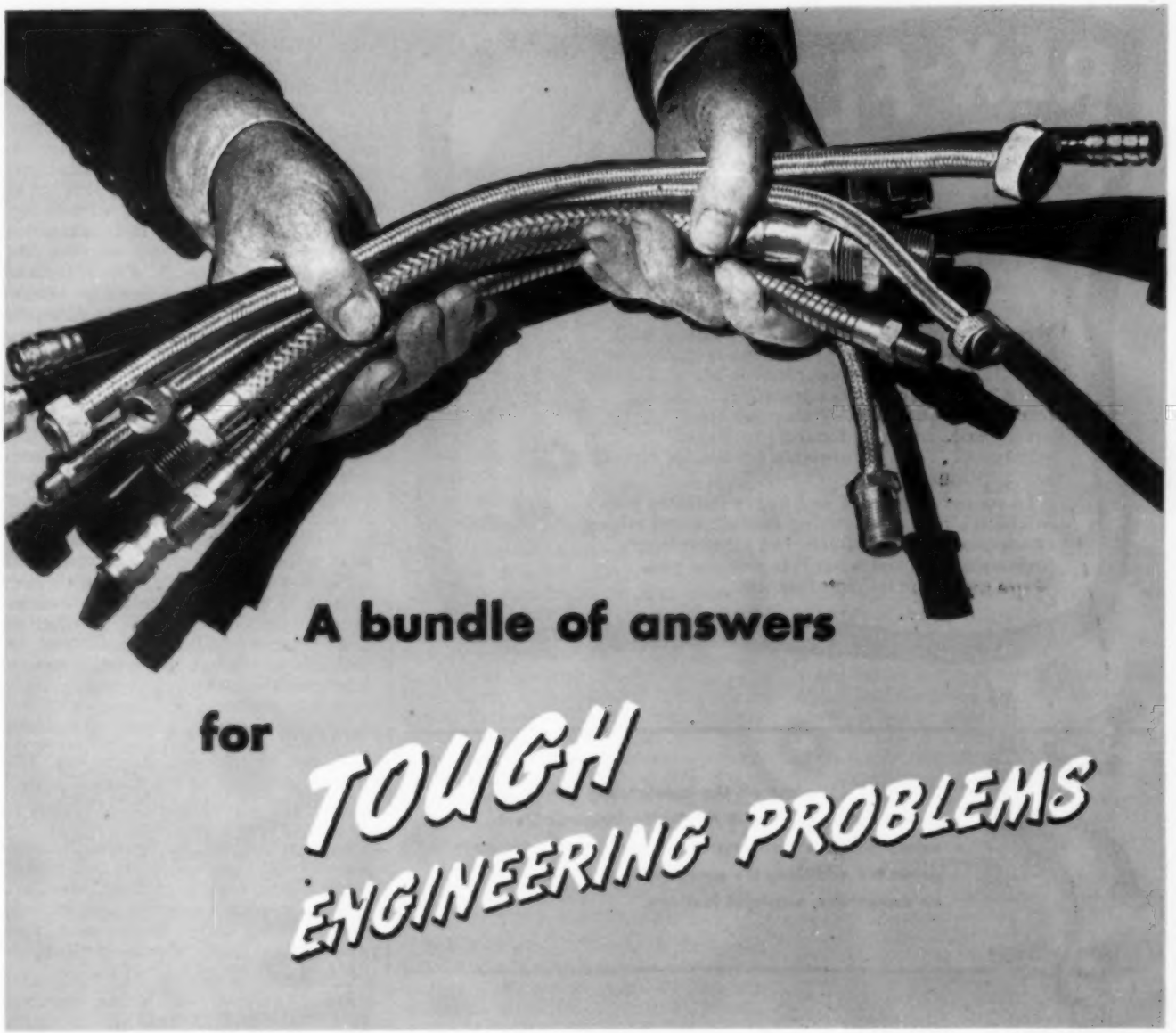
A SYNTHETIC thermoplastic resin emulsion adhesive designed for foil lamination has been developed by Paisley Products, Inc., 1770 Canalport Avenue, Chicago 16, Ill. Recommended primarily for roll applicator machines the new adhesive is claimed to bond all grades of aluminum foil to cellophane, acetate, glassine, and various grades of paper and board. It is white in color with a mild odor, weighing 9.70 lb. per gal. It has a viscosity of 400-500 centipoises with a pH of 4 to 4.5. It is soluble in water. This new material produces a flexible, transparent film which is odorless, non-toxic and waterproof. Suggested applications include the manufacture of moisture- and vapor-proof packages, waterproof aluminum foil labels, and other similar uses.

SHOCK RESISTANT COLORED PLASTIC

A RANGE of standard colors is now available in the rag-filled melamine-formaldehyde molding material manufactured by the American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y. Known as Melmac 3020 it is claimed to be the first thermosetting, shock resistant plastic available in color. Originally designed to combine strength with electrical and chemical resistant properties, this compound supplied in black is acceptable for many industrial applications. Now that it is available in color, it may be used for the many applications requiring color. Melmac 3020 is now available in commercial quantities. It is suggested for use in washing machine agitators, vacuum cleaner housings, sirup dispensers, shock-resistant food trays, refrigerator dip trays and many other commonly used consumer items.

FOAM PLASTIC

ANOTHER addition to the ranks of lightweight plastics is now available in experimental quantities from the E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Designated as CCA, cellular cellulose acetate is suggested for use in the manufacture of airplane floor panels, tail assemblies and wing structures, and in refrigerators, luggage and sections of prefabricated houses. CCA is lighter than cork and combines insulation against heat and cold with high structural strength when bonded between two sheets of metal, wood or plastic. Thermal insulation properties are approximately



VIBRATION, misalignment or connecting moving parts frequently creates a problem in economically conveying steam, oil, water and other liquids or gases. If such a problem confronts *you,* try this solution . . . install connections of American Flexible Metal Hose or Tubing.

Available in brass, bronze, aluminum, steel and other metals, in sizes ⅛" to 12" I.D., American Metal Hose is manufactured from strip in four spirally wound types. American Seamless Flexible Metal Tubing, flexible as garden hose and as leakproof as the seamless bronze tube from which it is made, is standard in sizes ⅛" to 4" I.D.

Either of these "American" products can be fabricated completely with end fittings to your specifications. You can thus obtain just the type of flexible connection that will best serve your needs.

For detailed information, write for Publication SS-50. In connection with exceptional problems, consult our Technical Department.

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY—*American Metal Hose Branch*—General Offices: Waterbury 88, Conn.
Subsidiary of Anaconda Copper Mining Company • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

the same as those of cork, balsa wood and other insulating materials. This material is uniform in shape and is not brittle nor will it crack or break down under vibration. CCA is now made in strips 3½ in. wide by ⅜ in thick and of any desired length. Strips may be readily glued together with thermosetting adhesives to form thick sections, and may be bonded with ease to metal, wood or other plastics. It is readily tooled with any woodworking machinery. It is anticipated that it will be made in four ranges of density: 4 to 5 lb. per cu. ft., 6 to 7 lb., 7 to 8 lb. and 8 to 9 lb. Commercial production of this new material in a wide variety of sizes is expected to begin late in the summer of 1946.

TEXTILE CHEMICAL

A NEW chemical treatment for textiles has been announced by the B. F. Goodrich Co., Akron, Ohio and the Treesdale Laboratories, Pittsburgh, Pa. Known as Permaproof, it is said to render any sort of fabric mildewproof, waterproof and flameproof without having any tenderizing effect on the base fabric. It is applied by dipping, spraying or painting and adds a minimum of weight to the fabric with no effect on color patterns. Suggested applications include tents, awnings, draperies, slipcovers, auto upholstery, etc.

COATING STRIPPER

KNOWN as cold wire stripper No. 416, recently developed by the Ellanar Chemical Co., 308 W. Randolph Street, Chicago 6, Ill., this product is used to strip wire covered with such coatings as Formex, Formvar, and enamel. Application of this product causes plastic coatings to break loose in a short time cutting expenses and in many cases avoiding danger to employees from wire brushes, knives, abrasive cloth, or gas flame, etc. It does not injure the wire.

PLASTIC STRIP COATING

DEVELOPED by the Naugatuck Chemical Division of the United States Rubber Company, Rockefeller Center, New York, a new plastic coating under the brand name of Kotol is tough, moisture-proof and resistant to salt water. It was developed originally for the Army Air Forces to protect planes on the decks of freighters and hangars during shipment overseas and should find many peacetime applications. It has low moisture vapor transmission, good elongation and toughness, having a tensile strength of 900 lb. per sq. in. Kotol has a wide temperature range with flexibility at —40 deg. and good aging characteristics at 180 deg. F. It may be applied by spraying or dipping, and it is then dried, either by air or vapor at 250 deg. F. Since the material has high resistance to acid and alkaline plating solutions at high temperatures, it is expected to be valuable as a rack coating and stop-off lacquer in the electroplating industry. With this application the coating, which may be stripped off, saves valuable metal by protecting the parts on coating racks and by masking parts of objects where electroplating is not desired. It is expected to find peacetime applications in shipment of machine parts, bottle sealing caps, and other similar services.

CHEMICAL ENGINEERING NEWS

ATOMIC BOMB SCIENTISTS GIVEN MEDAL FOR MERIT

In recognition of their work in connection with the development of the atomic bomb, the War Department has awarded Medals for Merit to a number of scientists who took a leading part in the successful completion of that project. The first presentations were made on March 4 in the office of the Secretary of War with the Hon. Robert P. Patterson, Secretary of War, bestowing the awards. The recipients were Dr. J. Robert Oppenheimer, California Institute of Technology, Pasadena, who was director of the Atomic Bomb Project Laboratory in New Mexico; Dr. Arthur H. Compton, chancellor of Washington University, St. Louis; Frank R. Creedon, Washington; Dr. John Ray Dunning, Columbia University; Percival C. Keith, Hydrocarbon Research, Inc., New York; Dr. Charles A. Thomas, vice president, Monsanto Chemical Co., St. Louis; Dr. Eugene P. Wigner, Princeton University; and Roger Williams, vice president, E. I. du Pont de Nemours & Co., Wilmington. The citations, signed by President Truman, were read by Col. Hugh M. Exton, aide to the Secretary of War.

On March 13, in the Pentagon Building, Major General Leslie R. Groves, commanding general Atomic Bomb Project, Manhattan Engineer District, made similar awards to Dr. Richard C. Tolman, dean of the Graduate School, California Institute of Technology, Pasadena, and to Dr. Robert F. Bacher, professor of physics, Cornell University.

On March 20, at the University of Chicago, Major General Groves officiated at a ceremony which gave Medal for Merit awards to Dr. Harold C. Urey for his work as director of laboratories at Columbia University; Dr. Enrico Fermi, self-exiled Italian physicist and now a staff member of the Institute of Nuclear Studies, University of Chicago; Dr. Cyril S. Smith, University of Chicago, who was co-chief of the Division of Chemistry and Metallurgy at the Los Alamos Laboratory; Dr. Samuel K. Allison, director of the Institute of Nuclear Studies, University of Chicago; and Dr. Robert S. Stone. University of California.

PLASTICS RESEARCH PROGRAM SET UP AT PRINCETON

A two-year contract calling for the expenditure of $100,000 for fundamental research in high polymer chemistry and engineering research in plastics has been awarded Princeton University by the United States Army Signal Corps. The work will be carried out principally by advanced students under the direction of a plastics committee representing the departments of chemistry, physics, chemical, electrical and mechanical engineering.

In addition to the Princeton committee, there has been established an advisory committee from industry whose members are: G. K. Scribner, Boonton Molding Co., chairman; R. J. Moore, Bakelite Corp.; A. E. Pitcher, E. I. du Pont de Nemours & Co.; W. S. Landes, Celanese Celluloid Corp.; E. B. Babcock, Firestone Tire & Rubber Co.; R. Hopkinson, United States Rubber Co.; N. A. Shepard, American Cyanamid Co.; W. J. B. Stokes, II, Joseph Stokes Rubber Co.; R. M. Burns, Bell Telephone Laboratories; R. V. Beshgetoor, Radio Corp. of America; W. H. Milton, Jr., General Electric Co.; E. A. Stillman, Watson-Stillman Co.; A. W. Fritzsche, General Industries Co.; F. H. Shaw, Shaw Insulator Co.; H. F. MacMillin, Arthur D. Little, Inc., and F. N. Williams, Monsanto Chemical Co.

The Army has proposed eight research projects from which several will be selected for active research. They will permit a substantial research staff working under the direction of Louis F. Rahm, associate professor of mechanical engineering. A plastics committee of the university, under the chairmanship of Professor Rahm, consists of Hugh Scott Taylor, dean of the graduate school; Kenneth H. Condit, dean of engineering; Joseph E. Elgin, chairman of the department of chemical engineering; Henry DeWolf Smyth, chairman of the department of physics and Clodius H. Willis, chairman of the department of electrical engineering.

NEW PRODUCTS EXPOSITION INDEFINITELY POSTPONED

The Products of Tomorrow Exposition which had been scheduled to open at the Chicago Coliseum on April 27 has been indefinitely postponed. Marcus W. Hinson, general manager of the exposition, reports that the national production outlook seems so clouded that the majority of manufacturers who originally planned to display their postwar products now consider it inadvisable to participate until they are more certain of their future capacity for delivery.

SHARES OF AMERICAN POTASH SOLD WITH RESTRICTIONS

Only one bid was received on March 27 by the Alien Property Custodian for the 478,194 shares of the American Potash & Chemical Corp. which were seized during the war under authority of the Trading With the Enemy Act. The successful bidder was a group made up of Kuhn, Loeb & Co., Glore, Forgan & Co., and Lehman Bros. The price offered and accepted was $32.29 a share and the buyers also agreed to assume the expenses incurred incidental to the sale. Offerings to the public will be made through a large number of investment companies scattered throughout the country.

The remaining 48,664 shares of the company have been classified as class A shares and the seized shares designated as class B shares. Both classifications carry the same voting rights and divided participation but the class B shares are to be sold with restrictions which prevent their resale to their original owners or to certain companies or competing owners of potash deposits.

NEW COMPANY WILL BUILD SULPHURIC ACID PLANT

Production of sulphuric acid is expected to begin before the end of this year in a plant which is under construction in Indianapolis, Ind. The plant will be adjacent to the Union Stock Yards and will furnish acid to the fertilizer companies in that vicinity. It will be owned and operated by the Marion Mfg. Corp. which was recently organized. Officers of the corporation are John E. Powell, president; R. D. Martenet, vice president; George H. Kingsbury, secretary; and Howard F. Kimball, treasurer. Cost of the plant and equipment will approximate $500,000 and production of acid is expected to reach an annual total of 50,000 tons.

Mr. Powell also is president of the Smith Agricultural Chemical Co.; Mr. Mertenet is executive vice president of E. Rauh & Sons Fertilizer Co.; Mr. Kimball is vice president of the Smith Agricultural Chemical Co.; and Mr. Kingsbury is president of Kingsbury & Co.

WESTINGHOUSE CENTENNIAL FORUM IN PITTSBURGH

A science and engineering forum honoring the centennial of the birth of George Westinghouse will be held in Pittsburgh on May 16-18. The opening session, titled "Science and Civilization" and presided over by Dr. Robert E. Doherty, president of Carnegie Institute of Technology, will include Dr. Isaiah Bowman, internationally prominent geographer and president of the Johns Hopkins University, and George W. Merck, president of Merck & Co., and special consultant to the War Department. Dr. Archibald V. Hill, foreign secretary of the Royal Society, will represent England.

Four aspects of "The Future of Atomic Energy" will be discussed the initial day of the Forum in a group headed by Dr. Karl T. Compton, president of the Massachusetts Institute of Technology. The group will delve into the biological, chemical, explosive and power possibilities of this new form of energy. A Nobel Prize winner from Columbia University, Dr. I. I. Rabi, will act as chairman at a dinner that evening at which Dr. Vannevar Bush will speak on "Planning in Science."

NEW ADMINISTRATIVE STAFF AT FRANKLIN INSTITUTE

Appointment of a new administrative staff to head the Franklin Institute laboratories for industrial research was announced recently by Dr. Henry Butler Allen, secretary and director of the Institute. Lt. Col. Charles H. Greenall, formerly director of

research at Frankford Arsenal, has been made executive director of the laboratories, assisting Dr. Allen who will continue in over-all charge of the research work. Acting as senior consultants to Dr. Allen are Dr. Rupen Eksergian and Dr. W. F. G. Swann. Dr. Swann is a director of the Bartol Research Foundation of the Franklin Institute.

During the war the Institute laboratories were greatly expanded. They are still engaged on projects for the armed forces, but soon will be expanded to cover a peacetime program of industrial research in the physical sciences.

MODELS OF OIL REFINERIES PRESENTED TO RUTGERS

As a contribution to the plans which Rutgers University is making for the expansion of its courses in chemical engineering, the Standard Oil Co. of New Jersey last month presented the university with an atmospheric pipe still model, a catalytic cracking plant model, and a pentane plant model. The models, which are valued at approximately $16,000, were presented by M. J. Rathbone, president of Standard Oil and himself a chemical engineer, who in his address said "These models have served us well, not only during the design and construction days of the plant equipment which they typify, but they have also been of great assistance to us in the training of our operating personnel. They are, in effect, a three

CONVENTION CALENDAR

American Tung Oil Association, annual meeting, San Carlos Hotel, Pensacola, Fla., April 26-27.

American Ceramic Society, 48th annual meeting, Hotel Statler, Buffalo, N. Y., April 28-May 1.

American Drug Manufacturers Association, annual meeting, Cavalier Hotel, Virginia Beach, Va., May 6-9.

National Association of Corrosion Engineers, annual meeting, President Hotel, Kansas City, Mo., May 7-9.

American Association of Cereal Chemists, annual meeting, General Brock Hotel, Niagara Falls, Ont., Canada, May 13-16.

American Oil Chemists' Society, annual meeting, Roosevelt Hotel, New Orleans, La., May 15-17.

National Foreign Trade Week, sponsored by Chamber of Commerce of the United States, Washington, D. C., May 19-25.

Metal Powder Association, spring meeting, Waldorf-Astoria Hotel, New York, N. Y., June 13.

Society for the Promotion of Engineering Education, 53rd annual meeting, Jefferson Hotel, St. Louis Mo., June 20-23.

American Chemical Society, 110th meeting, Chicago, Ill., September 9-13.

Fourth National Chemical Exposition, Chicago, Ill., September 10-14.

The Electrochemical Society, Inc., fall meeting, Hotel Royal York, Toronto, Canada, October 16-19.

dimensional picture of the completed plant. We constructed them before undertaking actual plant construction, chiefly to study the relation of each part of the unit with other parts, from the standpoint of facilitating maintenance in the completed unit. They provided us a useful means of visualizing and reviewing clearances for expediting repair work and metal inspection. They also were invaluable in studying the all important matters of safety. They assisted greatly in the pre-training of operators."

REPORT ON ATOMIC ENERGY STRESSES BENEFICIAL USE

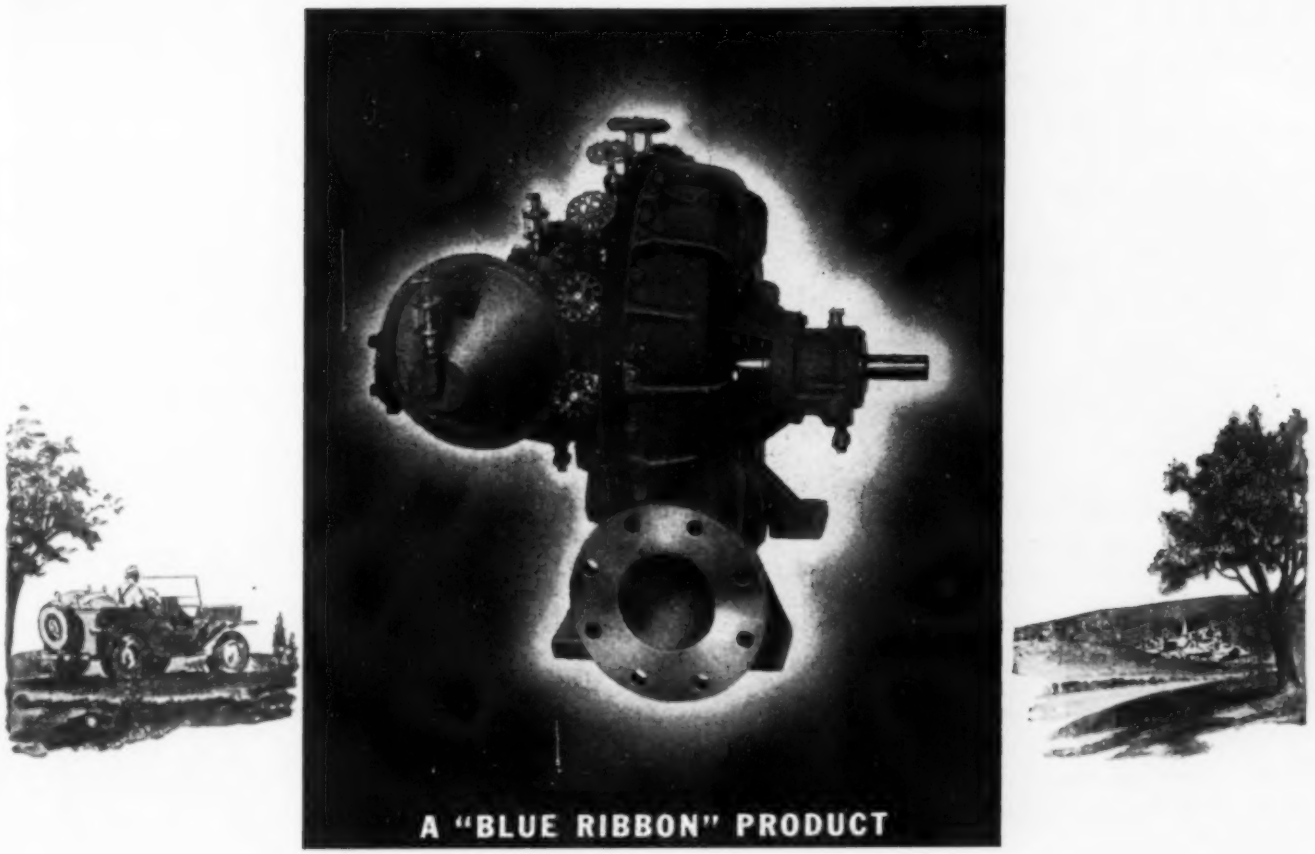
EXISTENCE of "two great fields" of beneficial use of atomic energy is stressed in the "Report on the International Control of Atomic Energy" released on March 28 by the State Department in Washington. Much importance is attached to the fact that U 235 and plutonium can be denatured from the standpoint of explosiveness and at the same time be successfully used in peaceful applications.

The report was prepared for the Secretary of State's committee on atomic energy by a board of consultants consisting of David Lilienthal (chairman), TVA; Chester I. Barnard, president of New Jersey Bell Telephone Co.; J. R. Oppenheimer, California Institute of Technology; Charles Allen Thomas, vice president and technical director of Monsanto Chemical Co.; and Harry A. Winne, vice president of General Electric Co.

Voicing their conviction that the peacetime applications of atomic energy are so enormous that the manufacture of fissionable materials must continue despite military potentialities and under international management, the consultants give much weight to the views expressed in an unpublished report by a group of scientists and engineers to the Secretary of War. This group describes the "two great fields" as "the development of atomic energy as a controlled source of power" and "the application of radiations and radioactivities to the growth of the sciences and the practical arts." The group says that "It is probable that the exploitation of atomic energy as a tool for research will outweigh the benefits to be derived from the availability of a new source of power."

"It should be understood," continues the report of this group, "that work specifically focused on atomic power need not and should not interfere with making available to biology, medicine, chemistry and physics the radiations and activities characteristic of this field . . . We should not be astonished if the greatest benefit of this program were in fact to lie in therapy for some of the neoplastic diseases, such as cancer, or in the increased understanding of biological systems or of the realities of the physical world, which will in turn open up new fields of human endeavor." With respect to power applications the group says, "We see characteristic limitations and advantages in atomic power which make us regard it in great measure as a supplement to existing sources, and an incentive to new developments, rather than as a competitor, let us say, to coal or to petroleum products."

The State Department's consultants urge the ownership and management by an international agency of "all intrinsically dangerous



THEY CALL 'EM JEEPS

BECAUSE THEY'RE SMALL, BUT POWERFUL, AND GO ANYWHERE

For a small, tough, hard-working turbine that will go anywhere and do all you expect of it . . . get a Coppus "Blue Ribbon" Steam Turbine.

Coppus Steam Turbines come in six frame sizes from 150 HP down to fractional—so you can match more closely your job requirements. Each smaller size is priced correspondingly less, so by selecting "horsepower" instead of "elephant power" you save on investment and installation cost.

Many well-known manufacturers install Coppus "Blue Ribbon" Steam Turbines on original equipment. They know Coppus quality will protect the reputation of their own products. The Coppus Turbine is also being used on many U. S. Destroyer Escorts, all Casablanca class aircraft carriers and 90% of all Landing Ship Docks.

Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), the Coppus Steam Turbine is a precision-made product, with accuracy controlled by Johansson size blocks. Every turbine is dynamometer-tested before shipment.

More than 85% of all orders since 1937 have been repeat orders.

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

Write for Bulletin 135-9. Coppus Engineering Corporation, 454 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

operations in the nuclear field, with individual nations and their citizens free to conduct, under license and a minimum of inspection, all non-dangerous, or safe, operations." Dangerous operations are classified as: (1) Prospecting, mine ownership or other control, mining and refining of uranium and, to a lesser extent, thorium, (2) enrichment of the isotope 235 by any methods now known, (3) operation of reactors for making plutonium and of separation plants for extracting it, (4) research and development in atomic explosives. The field of "safe" operations includes construction and operation of non-dangerous power-producing piles.

WESTVACO UNITES TECHNICAL SALES ACTIVITIES

All sales department technical affairs of the Westvaco Chlorine Products Corp., including market development and technical service, have been grouped into the technical sales division of which William T. Nichols has been appointed technical sales

William T. Nichols

director to coordinate and expand sales activities. Mr. Nichols has been engaged as technical assistant to the executive vice president and prior to that was in charge of research and product development at the corporation's plant in South Charleston.

K. W. Bayha will supervise market development work in the New York office and J. M. Smith will continue in charge of technical service. J. M. Payne will head technical consulting service for the middle west with headquarters in the Chicago office and A. George Stern will act in a similar capacity for the Pacific Coast with headquarters at the plant in Newark, Calif.

COMPANIES HOLD MEETINGS OF RESEARCH STAFFS

It is customary for chemical companies to hold annual conventions for their sales force in order to keep the men in touch with general policy and the direction of company policy. Recently the Wyandotte Chemicals Corp. held a formal one-day meeting in the Book Cadillac Hotel, Detroit, for the members of its research department. This meeting represented an innovation inasmuch as it was conducted along the lines usually reserved for a sales meeting. Dr. T. H. Vaughn, director of research for the company, opened the meeting and explained to

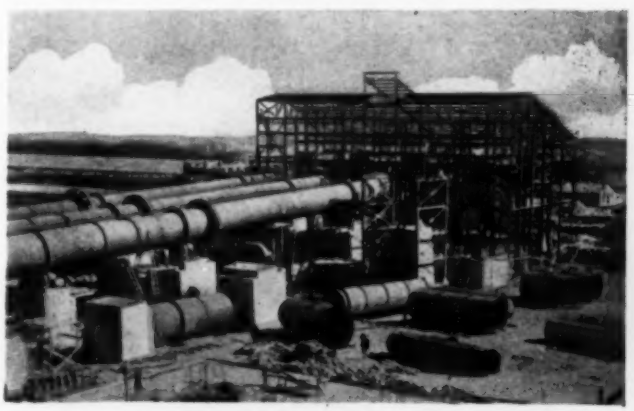
VULCAN KILNS

in South America's Largest Cement Plants

The recent installation of two Vulcan Rotary Kilns—each 8' and 9'-6" in diameter by 199 ft. in length—at Cementos El Melon, Calera, Chile (shown above) has increased the total capacity to 10,000 barrels per day; making it the largest cement plant in South America and one of the largest in the world. Four other Vulcan kilns of the same size and type were also installed recently at another large South American cement plant—Sociedad Cemento Juan Soldado—owned and operated by the same interests, at La Serena, Chile.

To the best of our knowledge and belief more Vulcan Rotary Kilns are operating successfully in modern cement plants throughout the world today than any other kind—undeniable evidence of their correct design and sturdy, dependable, construction.

For nearly half a century Vulcan Rotary Kilns, Calciners, Retorts, Dryers and Coolers have been widely used, also, for the manufacture of high-grade chemical lime, dehydration of bauxite, nodulizing and desulphurizing of ores, alteration of barytes, calcination of lithopone, processing of pigments, recovery of lime from paper-mill sludge, soda ash from black liquor, coke and other by-products from petroleum sludge, etc. As a natural consequence of this long and varied experience our engineers have acquired a vast fund of practical operating data—much of which cannot be duplicated elsewhere and all of which is available for solving the problems of prospective purchasers. Correspondence is cordially invited and constructive suggestions will be furnished, whenever possible, without charge or obligation.



Vulcan Rotary Kilns in process of installation at Sociedad Cemento Juan Soldado, La Serena, Chile.

VULCAN IRON WORKS

Established 1849

Main Office and Works **WILKES-BARRE, PA.,** New York Office 50 Church

Rotary Kilns, Coolers and Dryers	Toothed, Double-Roll Crushers	Heavy-Duty Electric Hoists	Steam Locomotives
Rotary Retorts, Calciners, Etc.	High-Speed Hammer-Type Pulverizers	Self-Contained Electric Hoists	Diesel and Gasoline Locomotives
Improved Vertical Lime Kilns	Ball, Rod and Tube Mills	Scraper-Loading Hoists	Diesel-Electric Locomotives
Automatic Quick-Lime Hydrators	Shaking-Chute and Chain Conveyors	Cast-Steel Sheaves and Gears	Electric Locomotives and Larrys

the 62 chemists and engineers in attendance that it was an experiment in a new method of bringing into focus for them the department's part in the over-all program of the corporation. He added that because the research personnel are housed in a dozen different buildings scattered over three plants, it was difficult for them to exchange ideas except in small groups and on specific problems.

Of a somewhat similar character was the recent meeting held at Skytop Lodge, Skytop, Pa., for 150 chemists, physicists and chemical engineers of General Aniline & Film Corp. The three-day meeting was devoted to discussions on new developments in the various research fields in which the company is engaged. It brought together research and technological workers from the company's plants in Grasselli, Rensselaer, Binghamton, Johnson City, and the Central Research Laboratory in Easton.

LIMITATIONS ON GERMANY'S CHEMICAL INDUSTRIES

AGREEMENT on severe limitations on German's chemical industries, including complete elimination of certain industries, is announced from Berlin by the Allied Control Council. State Department officials in Washington declare that the terms, which are subject to periodic revision, bear out in general the principles proclaimed by the United States as to how German industry should be controlled. Officials also believe the terms are consonant with the broad Potsdam objectives of rendering Germany harmless in the future and at the same time laying the basis for maximum reparations which are consistent with a minimum standard of living for Germany at present. The following information on the German chemical industries and related enterprises comes from the State Department in Washington.

Slated for complete elimination are German production facilities for: synthetic ammonia, synthetic rubber, primary aluminum, primary magnesium, beryllium, vanadium produced from Thomas slags, radioactive materials, hydrogen peroxide above 50 percent concentration, and chemicals and gases specifically for war purposes. Production facilities for synthetic oils, synthetic ammonia and synthetic rubber will be temporarily retained in operation to meet German domestic needs until necessary imports are available and can be paid for. Thereafter, the facilities will be removed.

To allow for German home requirements, 40 percent of the 1936 basic chemicals production capacity, in addition to presently retained capacity for synthetic ammonia, will be retained. Basic chemicals include: nitrogen, phosphates, sulphuric acid, alkalis, chlorine and calcium carbide. Seventy percent of the 1936 production capacity will be retained for other chemicals. Pharmaceuticals are set at the rate of 332 million reichmarks (1936 value) annually. The annual capacity for dyestuffs and synthetic textiles will be 36,000 tons and 185,000 tons respectively. No levels are established for the following classes of products: flat glass, bottle and domestic glass, ceramics and potash. Likewise, no limits are set for building materials, except that cement production capacity is limited to 8 million tons per year.

In the metal industry the steel capacity is fixed at 5.8 million tons annually. The fol-

THE PLASTICS INDUSTRIES LOOK TO . . .

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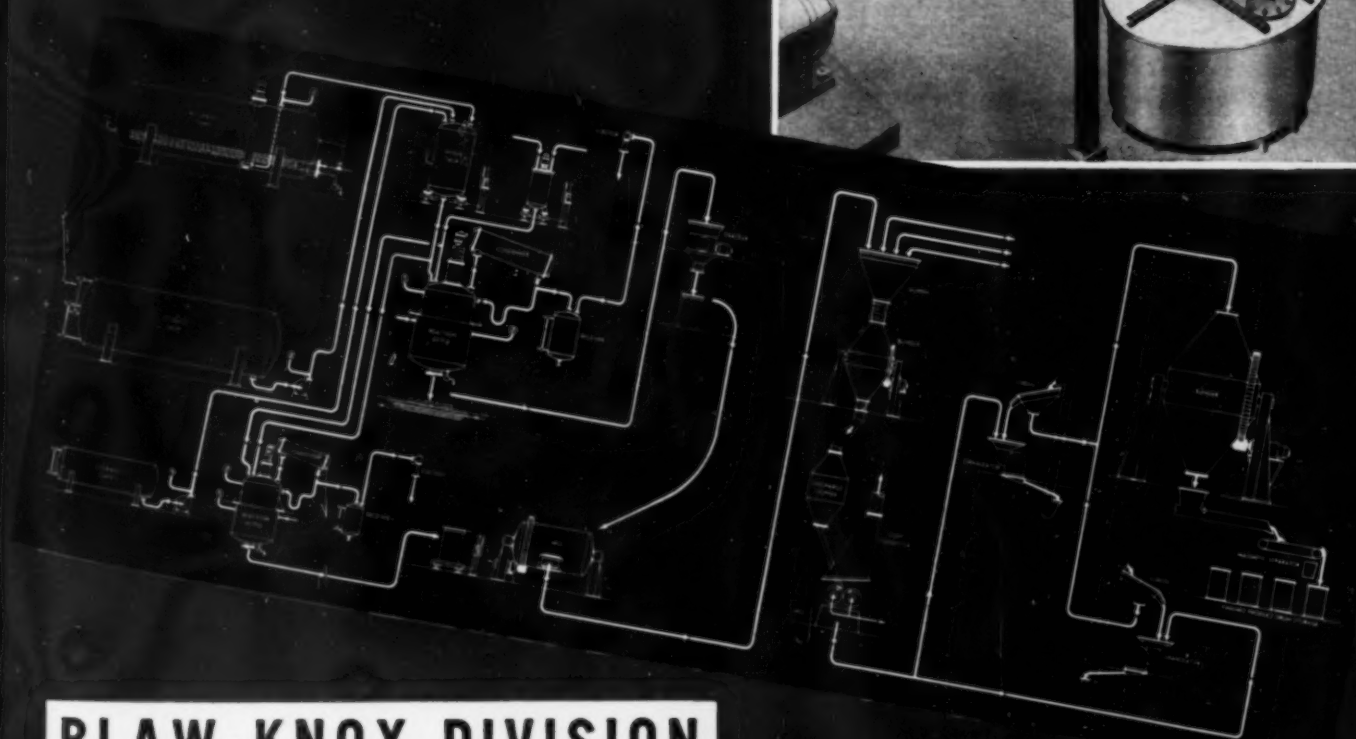
BLAW-KNOX has grown up with the Plastics Industries, collaborated closely with the leading plastics scientists and manufacturers, and is now building the most modern and complete equipment and plants needed in the production of commercial resins — phenolic, urea, melamine, cellulose acetate, alkyd, and vinyl.



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of BLAW-KNOX COMPANY
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BLAW-KNOX PROCESS EQUIPMENT

lowing consumption rates (annual tons) of non-ferrous metals from all sources are established: copper, 140,000; zinc, 135,000; lead, 120,000; tin, 8,000; nickel, 1,750. The German economy in 1949 is estimated to require 50,000 tons of rubber (imported), 2,129,000 tons of pulp, and 665,000 tons of fiber for textiles.

Looking at the general German industrial picture, the manufacture of oceanic ships and all types of aircraft is banned. Electric power capacity to the extent of 9,000,000 kw. is retained, this figure including all hydroelectric plants. Coal production is to be maximized, the potash production is to be at some point above the 1938 level. Machine tool manufacturing capacity is retained at only 11.4 percent of the 1938 figure.

The control plan is based on the assumption of a German population of 66.5 millions and contemplates that Germany will be administered as an economic whole.

DU PONT DROPS MILITARY EXPLOSIVES DIVISION

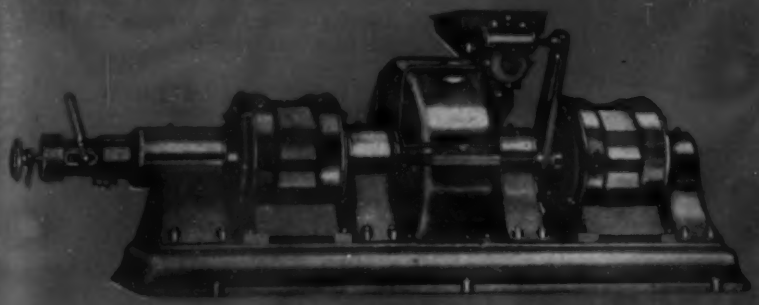
Since virtually all military explosives production of E. I. du Pont de Nemours & Co. has been completed, the military explosives division will be known as the nitrocellulose and sporting powder division, with F. W. Bradway as manager. J. M. Skilling, who was manager of the military explosives division, will be director of production of the new division. In other changes, P. J. Kimball, who was general superintendent of the department, becomes manager of the explosives division. F. R. Wilson, formerly division manager, becomes director of production; T. R. Carlson who was director of production becomes production manager of the high explosives section, and H. C. Peinert becomes production manager of the black powder section.

PERFECT SHIPPING CAMPAIGN OF ADVISORY BOARDS

For the last 10 years the Shippers Advisory Boards have set aside the month of April as a period when they try to focus the attention of all shippers upon all the factors affecting the movement of goods and to instigate thought and study to see what new progress can be made in perfecting distribution methods. The Perfect Shipping Campaign started this month is concentrated on the better marking of packages. J. E. Bryan, general chairman of the national management committee has sent out a poster and a leaflet in which he calls for teamwork on the part of all shippers in an effort to raise the standard of shipping practices.

NEW FORMALDEHYDE PAMPHLET OUTLINES SAFE HANDLING

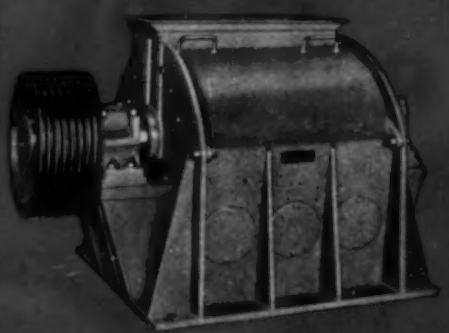
Control of hazards resulting from the industrial use of formaldehyde is outlined in the third of a series of pamphlets issued by the Division of Labor Standards, entitled "Controlling Chemical Hazards." Formaldehyde vapors, as the pamphlet points out, irritate eyes, mucous membranes and the skin. The characteristic symptoms are explained in the publication. It outlines the characteristics of formaldehyde, permissible and hazardous concentrations, safety and first aid precautions. Copies may be obtained from the Division of Labor Stand-



SIZE REDUCTION

There are many different types of size reduction machines. But, there is only ONE type which will perform your size reduction jobs BEST.

Let Sprout-Waldron's eighty years of experience in solving all kinds of size reduction problems work for you . . . bring your problem to Sprout-Waldron and get the benefits of wide experience with Attrition or Disc Mills, Knife Cutters, Roller Mills, Burr Stone Mills, Cone and Sawtooth Crushers. Remember, Sprout-Waldron's earnest desire is to recommend only the best machine for your application.

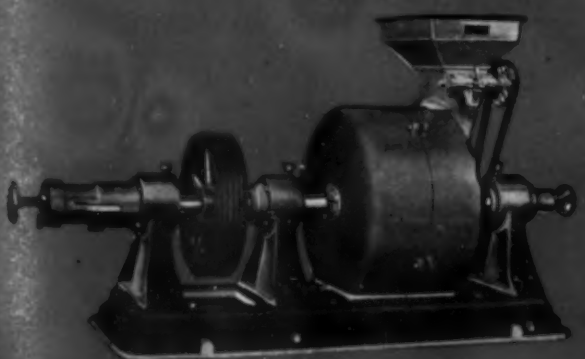


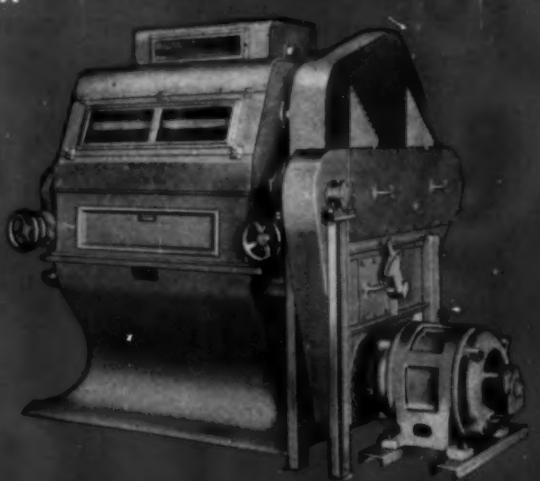
Consultants first--then manufacturers--and finally salesmen.

SPROUT-WALDRON & COMPANY

Manufacturing Engineers

MUNCY PENNSYLVANIA





ards so long as the limited free supply exists. Larger orders may be secured from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. at 10 cents per copy.

AMERICAN PATENTS OFFERED FOR DOMESTIC LICENSES

TWELVE patents owned by Walter Kidde & Co., Inc., Belleville, N. J. and Hercules Powder Co., Wilmington, Del., have been dedicated to the United States public and will be listed on the Register of Patents Available for Licensing which is maintained by the Patent Office. The Kidde patents include one designed to improve the means of storing explosives or dangerous fluids, one giving a method for producing inert gases, and a third giving a method for protecting combustibles, particularly applicable to tankers transporting oil, petroleum or gasoline.

The Hercules patents relate to improvements in varnishes and lacquers and the production of a rosin base ester-drying oil composition to replace tung oil.

PYRENE MFG. CO. RENAMES LINE OF EXTINGUISHERS

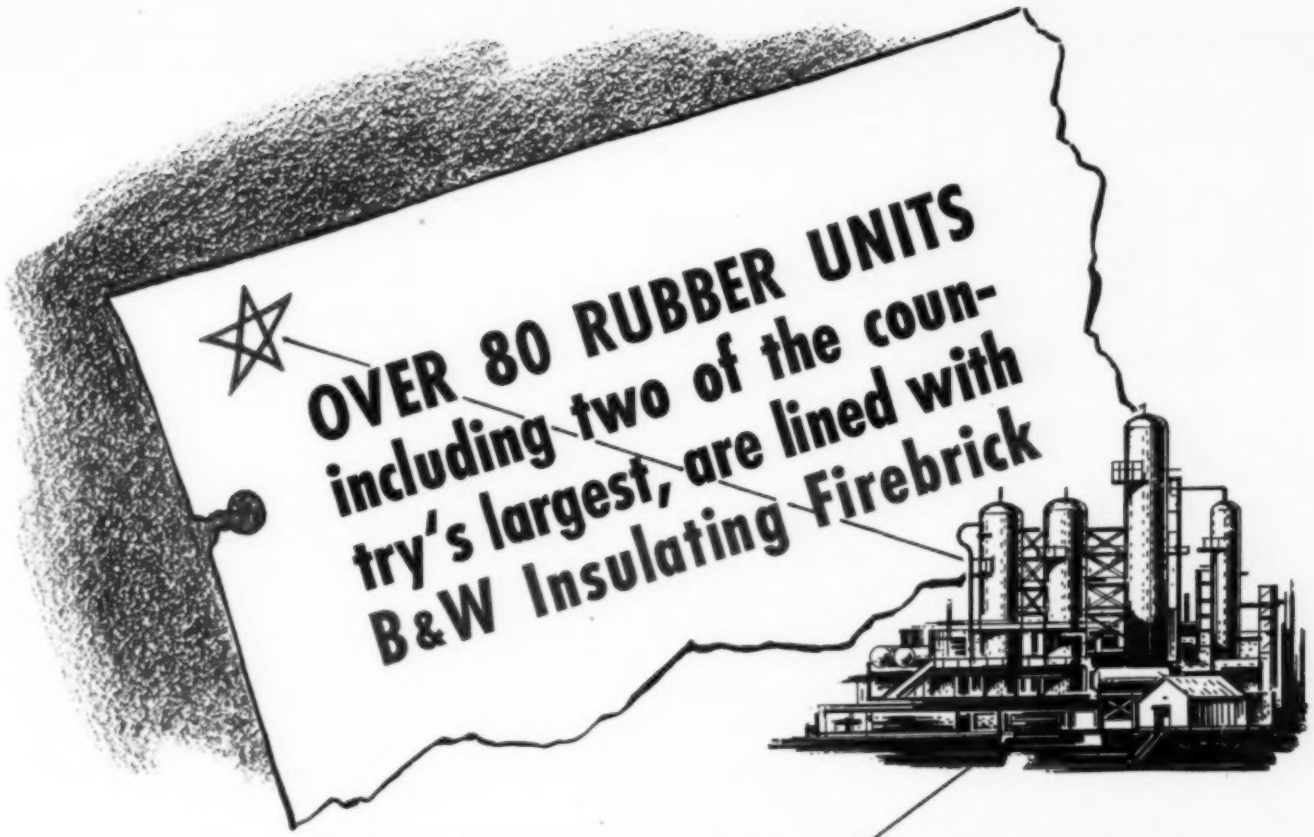
ALMOST 40 years ago when the Pyrene Mfg. Co., Newark, N. J., started in business by introducing a vaporizing liquid type of extinguisher for the new hazards of electricity and flammable liquids, it coined the trade name Pyrene. As other types of extinguishing compounds and equipment were added, they were given new coined names. Now the company has dropped these assorted trade names and renamed each of its products using the Pyrene name in conjunction with the type of unit. An exception is made in the case of exports where the difficulties peculiar to foreign markets make it advisable to retain the old names for the time being.

CONSTRUCTION PLANNED ON NEW PHOSPHATE PLANT

PLANS for immediate construction of a new phosphate mine and plant have been set up by the International Minerals & Chemical Corp. The plant is expected to have an annual capacity of one million tons and is scheduled to begin operation July 1, 1947. The plant will be built on the 2,000-acre phosphate property recently purchased near Bartow, Fla. The mine is considered by metallurgists to be one of the richest phosphate deposits in the country and its production will double International's phosphate output. The development will be called the Noralyn mine. The project will contain a number of metallurgical innovations developed by the company's research division.

MID-AMERICA EXPOSITION WILL BE IN CLEVELAND

MID-AMERICA EXPOSITION, an industrial exposition is scheduled for Cleveland, Ohio from May 23 through June 2. Public Hall and all exhibition halls will be turned into a show window where a display of postwar commercial and home products will be spotlighted. The purpose of the exposition is to focus national and international attention on the region's industries, craft skills, engineering resources, research facilities, adver-

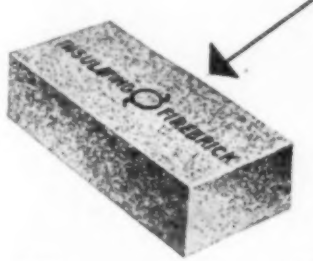


. . . and what this means to the refiner

The above statistical information can be interpreted by the refiner to his distinct profit.

B&W Insulating Firebrick were not chosen by the builders of these furnace units by chance, but by experience—the experience of the country's most expert and informed buyers of refractories.

These manufacturers *know* refractories. They realize the significance of temperature ratings, brick weight, hot-load strength and similar technical data. That is why they chose B&W Insulating Firebrick for 80 units which they built to produce synthetic rubber from petroleum. Their judgment is well worth following when you order refractory replacements. By doing so, you can be sure you will get insulating firebrick that fill *all* the requirements of insulating firebrick—low heat conductivity, low heat-storage capacity, rapid cooling when fires are shut off, and long life under direct exposure to furnace gases—with consequent fuel saving and minimized maintenance of furnace linings.



R-222

B&W

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
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tising, selling and distribution facilities. It is expected to draw approximately a quarter of a million people this year, and will have no geographical fences. Generally, however, the exhibitors are being invited from a region staked out by Detroit, Cincinnati, Pittsburgh and Buffalo, with Cleveland as the "capital." The show is not confined to any particular industry or group but will represent every type of industry in the region. The aim of the sponsors is to reach the scope of the prewar annual fairs at Toronto, Canada; Manchester, England; and Leipzig, Germany.

FLINTKOTE WILL BUILD NEW RESEARCH LABORATORY

CONSTRUCTION of a new research laboratory at Morristown, N. J., costing about $1,000,000 for plant and equipment has been announced by The Flintkote Co. This is part of a research, expansion, and modernization program representing a contemplated outlay of $10,000,000 of which $6,000,000 had been authorized by the end of last year. In addition to sections set aside to carry out research on the present products of the company, the new laboratory will be equipped with pilot plants for the development of new products.

METAL POWDER ASSOCIATION WILL MEET IN NEW YORK

THE Metal Powder Association will hold its annual spring meeting at the Waldorf-Astoria Hotel, New York, June 13. The program will include a day of technical and educational papers by leaders in powder metallurgy. Details of the program are being arranged by Robert G. Kenly, New Jersey Zinc Sales Co., who is chairman of the program committee, and Paul E. Weingart, American Metal Co., Ltd., vice chairman of the committee.

FINAL ABSTRACTS AVAILABLE ON VESTED PATENTS

THE second and final supplement to the abstracts of vested chemical patents is available, says the Alien Property Custodian. Abstracts of about 800 patents and patent applications are contained in the second supplement. Abstracts are grouped into 31 fields including chemicals, drugs, foods, unit processes, ceramics, plastics, pulp and paper, rubber and petroleum. Copies of the two supplements may be purchased from the Office of Alien Property Custodian, Chicago, Ill. The set of original abstracts, covering about 8,000 patents in the chemical field, is obtainable at $25.

U. S. RUBBER TO ESTABLISH PLANT IN SOUTH AFRICA

ACCORDING to an announcement by L. C. Boos, president and general manager of the United States Rubber Export Co., Ltd., the company has completed plans for the establishment at Port Elizabeth, South Africa, of a plant for the production of rubber tires and a varied line of rubber products. Equipment already has been ordered and installation and operations are expected to begin by the first of next year. Investment in the project will amount to approximately $5,000,000 and up to 1,000 people

Controlled OVERLAY THICKNESS WITH TWO NEW COLMONOY PROCESSES

Smooth and Free from Porosity

At last you can have all the advantages of Colmonoy hard-facing overlays—extreme resistance to corrosion and abrasion—without the disadvantages of heavy, welded overlays that require costly machining to finish to size and check for pin holes.

You can apply Colmonoy No. 6 in thicknesses from .020" to .040". The unretouched photograph at the right shows how smooth the application is. You eliminate porosity, save machining and secure overlays that have a Rockwell C hardness of 55-60 and greater corrosion resistance than stainless steel.

You can make the application and secure the same final results in either of two ways:

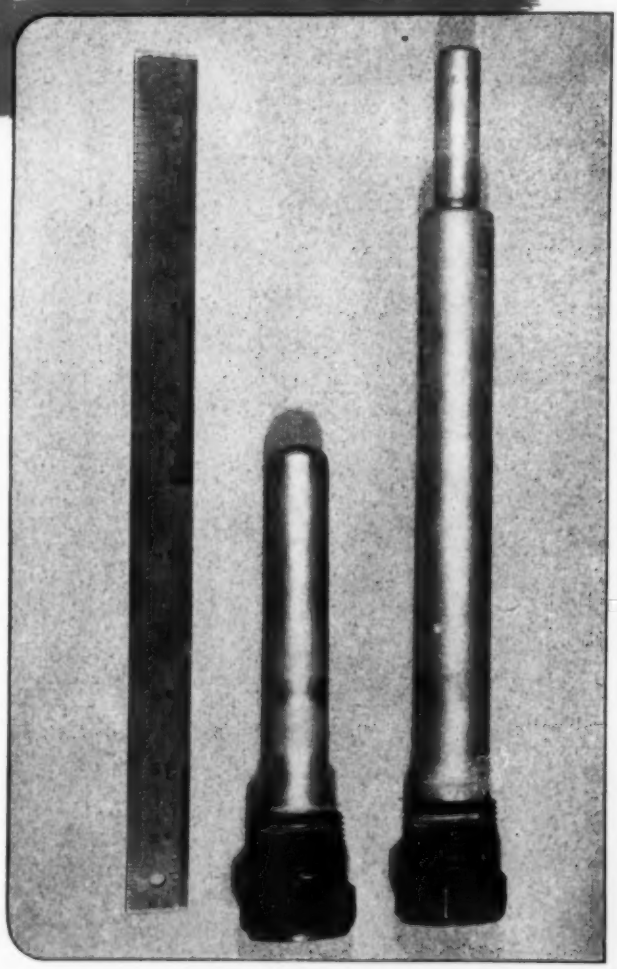
COLMONOY POWDER WELD PROCESS

Uses powdered Colmonoy and the Powder Weld Torch.

COLMONOY SPRAY WELD PROCESS

Uses ⅛" plastic bonded rod of Colmonoy in your ordinary flame spray metallizing gun.

Write for full information and step-by-step instructions for application.



Did you ever see a Hard-facing job so smooth?

This thermocouple tube overlay requires no machining after applying, either to bring to size or discover holes. It will outlast stainless steel. Laboratory tests show that in sulphuric acid tanks, for instance, its corrosion is only 5% that of stainless steel, at all concentrations. It tests from 55 to 60, Rockwell C.

WALL COLMONOY CORP.

720 Fisher Bldg., Detroit 2, Michigan

will be employed and trained by a staff of specialists from the domestic organization until native workers become qualified to take over. Since 1919 the South African territory has been served through the United States Export Co. of which Bland Scott, a South African, is managing director. The new plant is intended not only to satisfy South African requirements but also to export its products to Rhodesia and Central Africa.

READERS' VIEWS and COMMENTS

GIVE US MORE

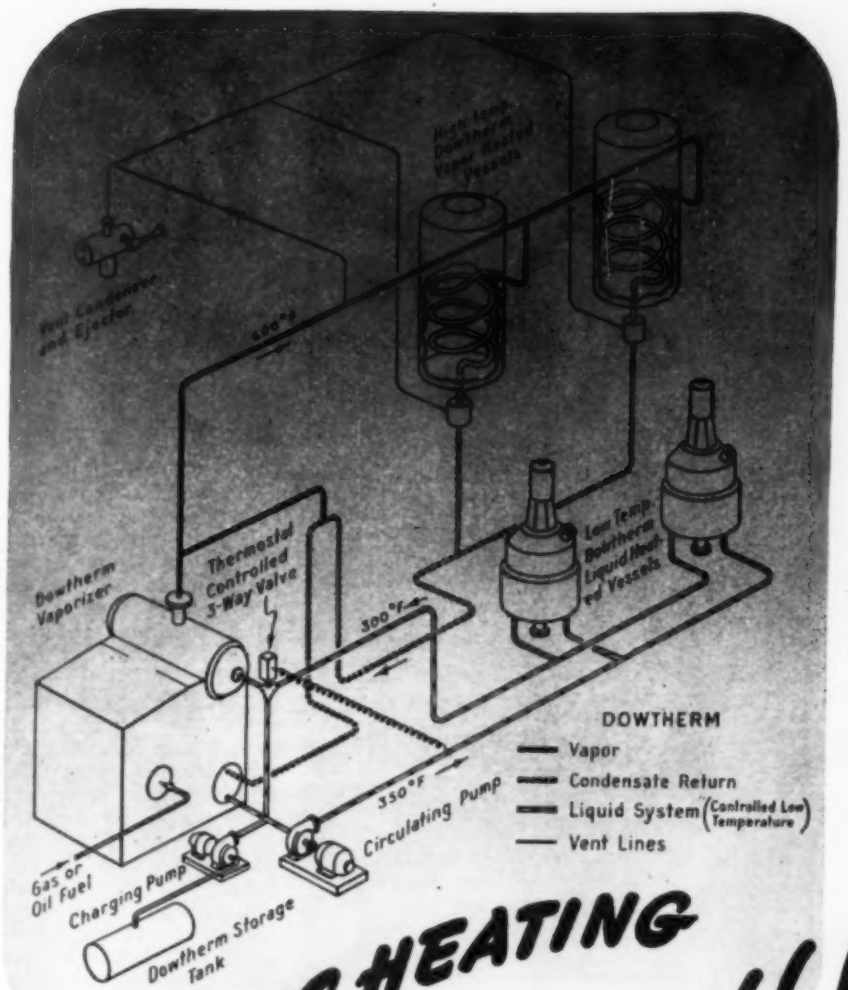
To the Editor of Chem. & Met.:

Sir: — By means of this letter I wish to compliment you on the excellence of the articles which have appeared in *Chemical & Metallurgical Engineering* regarding engineering aspects of atomic bomb production, and to hope that further articles of the same type will follow.

I refer, of course, to J. F. Hogerton's article in the December issue on the gas diffusion process, and to Col. Fox's very brief article in the same issue on the thermal diffusion plant. It seems to me that this latter plant, employing a process that has been very little mentioned, and whose mechanics are almost unknown to the ordinary engineer, deserves more extensive treatment. I also refer to the excellent article by P. C. Keith in your February issue.

As an official of one of the firms supplying equipment extensively to this project, I appreciate keenly the secrecy limitations and the difficulty of telling a story which will be useful and interesting, and at the same time will not disclose any military secrets. However, the above authors, particularly Keith, have all solved this difficult problem. Without disclosing any secret information, they have managed to do three things: First, they have helped to give us a better picture of the tremendous complexities involved in this work and of the amazing wartime achievement, of which every engineer can be proud. Second, they have given a somewhat clearer and more complete picture of the process details of at least certain phases of this program. These details are naturally of interest to every engineer and scientist, in view of the fact that the successful use of atomic energy is undoubtedly the greatest scientific achievement of all times. Third, they have given hints of new techniques, new methods and new equipment, which will be useful in other fields. These have been hinted at elsewhere, but with not enough definiteness so that an engineer outside of the project could tell whether or not these things were actually useful to him. These articles have started the necessary job of informing other engineers of new techniques and new equipment, so that these war-born developments can be put to practical use in other fields besides this specialized one.

The prime purpose of this letter is to urge that such articles be continued and that they cover other phases of the atomic bomb project. More information is needed, for example, on the thermal diffusion plant, and there should be an article or series of articles on the electromagnetic separation plant. Of course, it goes without saying



PROCESS HEATING FLEXIBILITY...

FLEXIBLE . . . High-temperature vapor heating proceeds independently of low-temperature liquid-phase heating in this processing system. Pressure in the vessels heated at 600° *F* is only 28 lb. gage, much less in the low-temperature system. Both systems are heated by a *single vaporizer.*

Dowtherm is the heating agent. The vaporizer is the compact "D" type tubular unit arranged for either oil or gas firing. The entire system is designed, constructed and installed by Foster Wheeler.

Bulletin ID-46-3 describes Dowtherm process heating for a variety of services. Request a copy from any Foster Wheeler branch office, or address—

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FOSTER WHEELER

that there should be a whole series on the Hanford Engineer Works and its unique problems of remote control, disposal of dangerous radioactive byproducts, etc. In view of what you have already done, I feel certain that even in the face of rigid secrecy limitations articles can be prepared and properly cleared by the Manhattan District which will be interesting, informative and useful to process engineers everywhere. Keep up the good work.

R. J. KRYTER, *Treasurer*
The Esterline-Angus Co., Inc.
Indianapolis 6, Ind.

MANGANESE ARTICLE CRITICIZED

To the Editor of Chem. & Met.

Sir:—I have read carefully the article in your March 1946 issue entitled "Electro-Process Developed to Produce Metallic Manganese." There is a statement made in the article that "the process (at the Electro Manganese Corp. at Knoxville, Tenn.) is the same as that developed by the Bureau of Mines." There is a further statement that "small scale production by this method (i.e., the Bureau of Mines) was begun in 1939."

These statements are decidedly misleading, particularly inasmuch as the first plant of the Electro Manganese Corp. was designed by personnel of the Bureau of Mines for 5,000 lb. a day and produced 100 lb. a day and was an operating failure. From that point on, the Electro Manganese developments were such as to result in a considerable number of patents which cover various stages of the Electro Manganese Corp. processes and make the procedures of that company a distinct entity. Apparently the only thing that the two processes have in common is that they are both based on manganese ores and employ electrowinning and electrolytic operations. This hardly makes them the same.

Certain steps in the flowsheet illustrated on page 107 bear considerable resemblance to the scope of issued Electro Manganese Corp. patents.

Something of the order of ten million pounds of electrolytic manganese have been produced and adequate production costs have been kept as records. Plants were projected for much larger capacities up to 50 tons a day. The article in the March *Chem. & Met.* indicates that electrolytic manganese might be considered to have a future cost, on the basis of Bureau of Mines estimates, of the order of electrolytic zinc. These figures are so far away from the actual production cost in continuously operated commercial plants that they can be considered to be definitely misleading. They apparently have resulted from the projection of short-term operation of experimental units. This type of reasoning in the metallurgical and electrochemical industries has many times in the past been shown to be full of pitfalls.

A number of years of operation of electrolytic manganese processes as developed by the specifically different operations of the Electro Manganese Corp. in contrast to those of the Bureau of Mines, does not appear to justify the optimism expressed in the article.

C. L. MANTELL
Consulting Engineer
Electro Manganese Corp.

Headquarters for the San Francisco convention of the American Institute of Chemical Engineers during August 25-28 will be in the Palace Hotel (large rectangular building with inner court, lower right). In the background are the Bay Bridge, Berkeley, Oakland, Alameda and Mt. Diablo

PACIFIC PROCESS INDUSTRIES

TRENDS • EVENTS • DEVELOPMENTS

JOHN R. CALLAHAM, Pacific Coast Editor, San Francisco, Calif.

AIChE TO CONVENE IN SAN FRANCISCO

PLANS for the first convention of the American Institute of Chemical Engineers in the West since 1924 are now materializing. The date has been set at August 25-28 and the convention headquarters will be at the Palace Hotel, San Francisco. Theme of the meeting will be "New Chemical Industries of the West," while one symposium on chemicals from petroleum has been definitely scheduled. There will also probably be a round-table symposium on "Chemical Engineering Education in the West." Vacation attractions of the West are being stressed, and moves are now well under way to provide regional "vacation consultation" services for those persons desiring further information on any particular locality. C. R. Nelson of Shell Development Corp., San Francisco, is general chairman in charge of the program, while George C. Gester, Jr., of California Research Corp., Richmond, has charge of arranging plant visits.

SHELL DEVELOPMENT ANNOUNCES MAJOR EXPANSION

ALREADY one of the two largest research and development organizations of the United States in the field of petroleum processing, Shell Development Co. has recently announced plans to expand its Emeryville, Calif., research laboratories by a capital expenditure of more than $3,500,000. Construction of the new facilities, involving erection of three major new buildings and extensive remodeling of present units, will begin this spring and continue over a two-year period, according to A. E. Lacomblé, president of Shell Development Co.

Architectural plans now approved show the largest of the new buildings as an eight-story structure with basement, designed primarily to house the research laboratories. It will be of steel and concrete construction. The second major building will in reality be a five-story addition to the present administration building in Emeryville. Its completion will necessitate modernizing existing facilities to harmonize with the new construction and will double the space now available for office and staff workers. The third structure is designed for heavy equipment. It will reach four stories with a basement and will house the large-scale laboratory facilities and service shops. In addition to the new buildings, Shell Development's expansion program calls for a substantial expenditure to remodel present facilities, construct small experimental plant buildings and provide new furnishings and equipment.

Established in 1928 with a staff of 35, Shell Development Co. has done much pioneering research on improvements in petroleum manufacturing processes and products as well as in the development of a chemical industry based on petroleum hydrocarbon raw materials. By 1939 the Emeryville staff had grown to 600 and by the end of the war this figure had increased to approximately 1,000 of which 350 were chemists, chemical engineers and other technical personnel. The Emeryville laboratories, now the largest research organization in the West, will employ 1,200 persons in 18 functional departments when the present 25 percent increase in staff is completed, it was reported by W. J. Hund, manager and associate research director of the laboratories.

This proposed building will house the research laboratories of Shell Development Co. in Emeryville, Calif. It is one of three major structures included in a $3,500,000 expansion program being undertaken by Shell's research organization

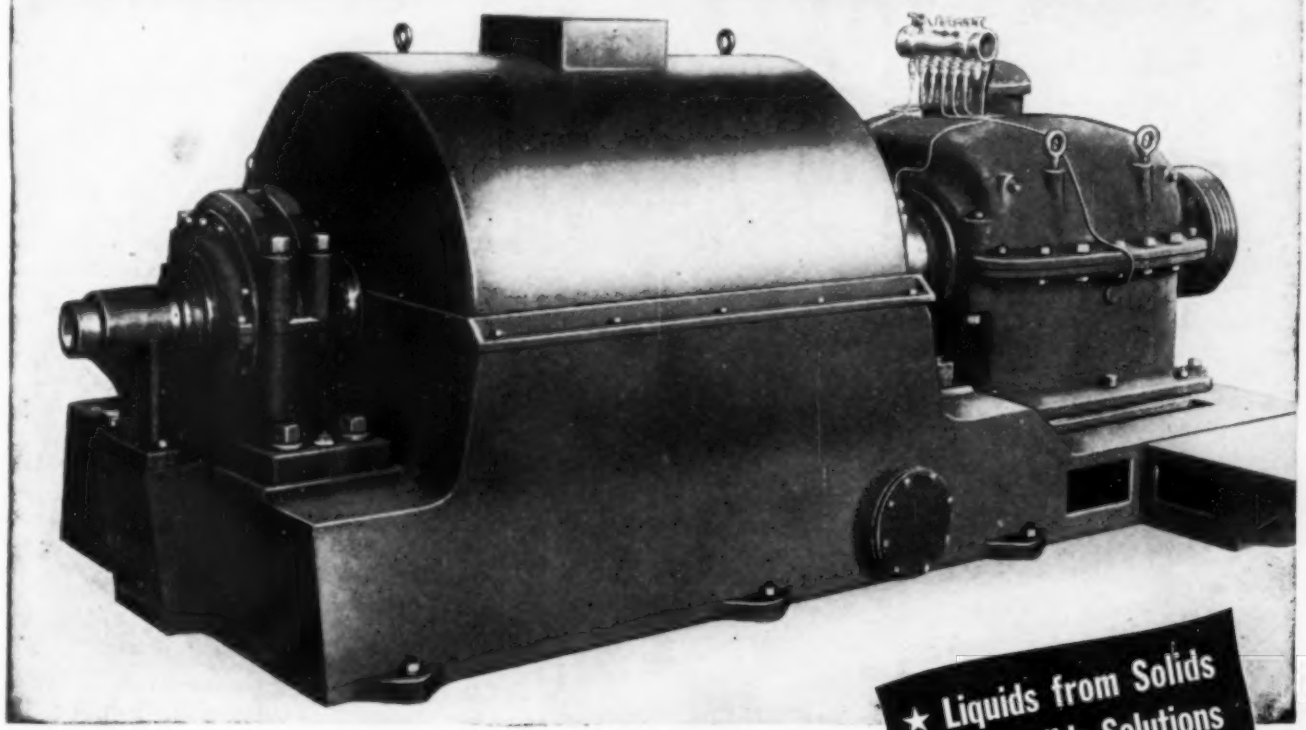
GENERAL CHEMICAL BUYS SULPHURIC PLANT

PURCHASE of the $552,000 sulphuric acid plant at Richmond, Calif., by General Chemical Co., wartime operator of the unit, has now been definitely settled, according to reports. The company has been operating the plant under a temporary lease. All manufacturing facilities, consisting of the conventional type of equipment, are built in the open and the only building is a one-story administration unit of 2,000 sq.ft. The plant has a design capacity of 65,000 tons annually of acid from sulphur shipped by barge from the Gulf Coast. It occupies a 10-acre site near the Richmond refinery of Standard Oil of California and was built under government sponsorship primarily to supply sulphuric acid to petroleum refineries. Other sulphuric acid plants owned and operated by General Chemical Co. in California are located at Nichols on San Francisco Bay and at El Segundo, near Los Angeles.

SODA ASH PRODUCTION SETS NEW RECORD

SODA ASH production on the Pacific Coast is still insufficient to meet consumption needs, according to reports during mid-March, and this chemical has been particularly tight in the area. Western production and sales for 1945, altogether from four natural producers in California, was at the record figure of 182,100 tons, according to preliminary figures from the U. S. Department of Commerce, as compared to the

CME Continuous CENTRIFUGE



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★ Immiscible Solutions

For Fast, Continuous Separation

The new CME Continuous Centrifuge sets new standards in centrifugal filtration. It extracts solids from liquids and separates immiscible liquids of unequal specific gravity at lower cost than with any other type equipment. There are no filter elements to renew or service. Operation is continuous, uninterrupted, and automatic. The unit is entirely self-contained and requires little floor space.

CME Continuous Centrifuges are available in a variety of sizes and models to meet different requirements. Granular, amorphous, and crystalline materials such as caustic recoveries, salts from brine solutions, sugars, coal, scrap rubber, ground cork, cut sponge, and pulps are separated and washed at from 2 to 15 tons per hour. For separating fines or mixed sizes fractionated to particle size or specific gravity, for refining or degritting clays or non-metallics, and for treating slimes, crystalline and fibrous matter, metal salts, fish reductions, and fine chemicals models of 1 to 6 tons per hour capacity are available.

CME Continuous Centrifuges are designed and built by pioneers in this modern, efficient, low cost type of filtration. Our engineering analysis of your problem will not obligate you. Send for full details.

Continuous
- ★ **Dewatering**
- ★ **Classifying**
- ★ **Fractionating**
- ★ **Degritting**
- ★ **Thickening**
- ★ **Extracting**

CENTRIFUGAL MECHANICAL EQUIPMENT, Inc., N. J.

Specialists in centrifugal separation

95 River Street, Hoboken, N. J.

1944 output of 179,600 tons and the 1943 figure of 165,700 tons. The 1945 California output represents about 4 percent of the total United States production of this chemical.

For a number of years, California production of soda ash has been insufficient to supply West Coast requirements. Although no official figures on consumption are available, private estimates on the deficiency within recent years range from 30,000-45,000 tons annually. Reason for this situation has been in the large wartime expansion of consuming industries, of which glass manufacture is the largest, with substantial amounts going into soaps and detergents, petroleum and sugar refining, paper, ceramics and non-ferrous metallurgy. Glass and soap, in particular, are still undergoing expansions, with a number of new plants announced or under construction. Prior to 1943, one producer of caustic soda by the lime-soda process in southern California represented one of the larger independent chemical users of soda ash; there is no bicarbonate production in the West.

Western output of soda ash is normally by four California producers of the natural product: American Potash & Chemical Co., Trona; Natural Soda Products Co., Keeler; Columbia Chemical Div. of Pittsburgh Plate Glass Co., Bartlett; West End Chemical Co., West End. The last of these firms has recently made known a considerable expansion program in soda ash production facilities.

NEW OXYGEN PROCESS SHOWS PROMISE

IN REVEALING a chemical method of preparing pure oxygen from the air, Dr. Melvin Calvin, associate professor of chemistry on the Berkeley campus of the University of Califorina, stated that the new process was first used in the South Pacific in preparing oxygen needed for welding and other repairing which had to be completed away from regular repair bases. Conceived by Dr. Calvin and associates while working on means of indicating oxygen changes in submarines, the initial findings were submitted to the National Defense Research Committee which sponsored additional research at the University of California in Berkeley and Los Angeles, California Institute of Technology, Massachusetts Institute of Technology and Iowa State College. The new method was first announced by Dr. Calvin before a meeting of the California Section of the American Chemical Society in March.

The process, which has been considerably improved since its conception in 1940, uses a simple tubular heat exchanger filled with crystalline granules of a new chemical compound, the cobaltous chelate formed from 3-fluorosalicyl-aldehyde and ethylene diamine. Low-pressure air is blown through the material, which absorbs up to 4.3 percent by weight of oxygen per cycle, and turns from red to black. Water cooling around the tubes is necessary for maximum absorption. When the air flow is stopped and the tubes heated with hot water or steam, the chelate liberates the absorbed oxygen as an extremely high-purity gas which can be pumped to regular storage tanks. Although there is a slow decrease in productivity with use, the cycle could probably be repeated over 2,000 times before regener-

ation of the chelate by recrystallization becomes necessary.

Greatest promise of the new method is believed to be for generating oxygen for intermittent or small-scale use in welding and other operations at locations remote from industrial oxygen-producing plants and in instances where the cost of shipping, handling and storing cylinders would be excessive. Other advantages of the process for such purposes are stated as (1) simplicity of equipment and operation; (2) flexibility in size, since an economic unit can be made as large or as small as desirable; (3) low power requirements, since the air need not be compressed to more than 20 lb. gage; (4) the fact that ordinary industrial waste heat, waste steam or 100 deg. water can be used for liberating the oxygen.

Determining factor in the economics of the Calvin process will most likely be the cost of the chelate chemical. Although never yet produced on a large scale, it is understood that there is interest in the possibilities of synthesizing the chemical industrially.

WESTERN CHEMICAL GROUPS SHOW HEALTHY GROWTH

REFLECTING the increased growth and stimulation of the chemical and process industries of the West, membership in the American Institute of Chemical Engineers and the American Chemical Society has increased considerably, recent compilations show. With both organizations, membership in the West as a region has increased more than the national average, with Washington, Oregon, California, Utah, Colorado and New Mexico in the lead. Detailed figures are shown in the accompanying table.

Western Chemical Membership Growth*

	Amer. Chem. Soc.			Amer. Inst. Chem. Eng.		
	1940	1946	%	1940	1946	%
Wash.	194	366	89	16	60	275
Ore.	110	192	75	3	12	300
Calif.	1,322	2,834	114	45	286	536
Mont.	61	57	—	4	3	—
Idaho	28	24	—	1	2	—
Nev.	17	42	147	1	2	—
Utah	43	96	123	1	6	—
Ariz.	21	34	62	1	—	—
Wyo.	20	38	90	—	—	—
Colo.	157	212	35	10	30	200
N. M.	26	92	254	1	6	—
Total	1,999	3,987	100	83	407	391
Total U. S.	21,033	40,589	93	3,161	5,775	83

* Figures for the American Chemical Society are for Dec. 31 of the years previous to those indicated; those for the American Institute of Chemical Engineers are for Jan. 1 of the years indicated.

ALCOA MOVES STIR INTEREST IN OREGON BAUXITES

PLANS for shipping high-grade Alaska limestone into the Portland, Ore., area and at the same time developing recently discovered high-aluminum iron ores in northwestern Oregon have been announced by Aluminum Co. of America. Alcoa itself is a potential future consumer of the limestone, states C. S. Thayer, works manager of the firm's privately-owned Vancouver, Wash., plant, while at the same time availability of the material will solve the problem of high-grade lime for other existing and potential industries of the area.

Alcoa Mining Co. is reported to have spent around $500,000 in exploratory work on the ferruginous bauxite ores of Washing

REDUCING MATERIAL COST OF LARGE CORROSION-RESISTANT EQUIPMENT

Steam-heated salt drier, fabricated by Hersey Manufacturing Company, South Boston, Mass., of 20% Lukens Nickel-Clad Steel and 20% Lukens Monel-Clad Steel. The drier is 26′ 0-1/4″ in length, 7′ 0″ in diameter, and has a capacity of 8 tons an hour.

Driers... that can take it!

TO COMBAT the corrosive and abrasive action of wet salt, Lukens Monel-Clad Steel is the ideal choice of material for the wet end of the large drier above. The even more economical Lukens Nickel-Clad Steel is used for the dry end where the action is less severe. By preventing metal pick-up and protecting the product from contaminating by-products of corrosion, product purity is assured. Lukens Monel-Clad and Nickel-Clad Steels have for many years been standard materials of construction for salt handling equipment, where, in addition to protection of product purity, for production economy continuous operation is essential.

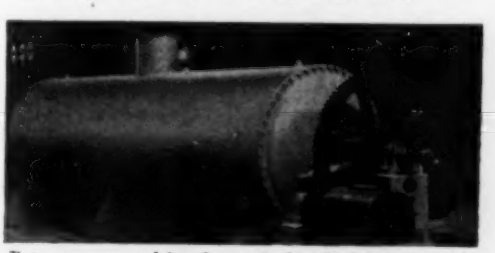
Lukens Clad Steels — Nickel-Clad, Inconel-Clad and Monel-Clad — are also recommended for large drying and dehydrating equipment handling other chemicals and pharmaceuticals.

Consisting of a layer of nickel, Inconel, or Monel permanently and homogeneously bonded to a heavier backing plate of steel, Lukens Clad Steels offer protection against metallic contamination and prevention from corrosion for equipment requiring plate thicknesses, at savings in material cost up to 60% over the cost of solid nickel, Inconel, or Monel. Bulletin 255, "Lukens Clad Steels" gives complete information and additional applications. Your copy on request.

LUKENS STEEL COMPANY • 315 LUKENS BUILDING • COATESVILLE, PA.

Drier for pharmaceuticals, constructed of 20% Lukens Nickel-Clad Steel by Struthers Wells, Warren and Titusville, Pa. The pan is 5′ 9″ in diameter, 1/2″ thick, with carbon steel jacket.

Drier for chemicals, 2′ 6″ in diameter, 10′ 0″ long, fabricated by Henderson Barwick Company, Limited, Montreal, Canada, of 20% Lukens Nickel-Clad Steel.



Rotary vacuum drier for agricultural chemicals, with inner shell fabricated of 20% Lukens Nickel-Clad Steel by Struthers Wells, Warren and Titusville, Pa.

ton County, Ore. More than 16,000 chemical analyses from drill cores indicated that the deposits, estimated at over 3,500,000 long tons, contain about 25-35 percent Fe, usually more than 30 percent alumina, and about 6.0-6.5 percent each of silica and titanium. While this laterite is lower in alumina than the Arkansas bauxites used during the war for producing alumina, the high iron oxide content will make possible the production of marketable iron through a process being developed by Alcoa, company engineers predict.

The firm has not indicated the nature of the process under development, but in Thayer's statement was a guarded forecast of a plant that will produce both alumina and pig iron; at present there is no large-scale production of alumina in the Northwest. It has been suggested that a modification of the Pederson process, which has been used in Norway on similar ores, might be used economically. In this process the ore is mixed with lime and coke in an electric furnace and the molten pig iron drawn off, leaving a calcium aluminate slag which is treated with hot soda ash solution containing some caustic soda to liberate aluminum hydrate.

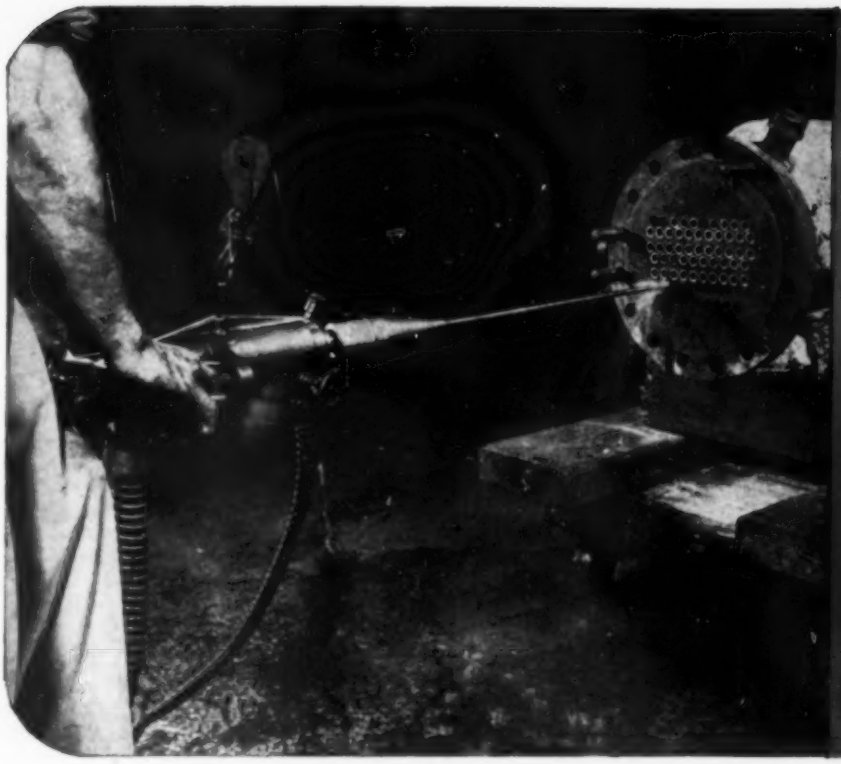
MAJOR SODA ASH EXPANSION UNDER WAY AT WEST END

In order to help supply the sharply increasing demands for soda ash on the Pacific Coast, West End Chemical Co., Oakland, Calif., has undertaken an expansion of its Searles Lake plant that will increase the firm's capacity for producing natural soda ash by about 67-75 percent. The expansion involves additional housing and plant improvements to cost approximately $750,000. The plant changes, now under way, will include installation of a battery of stainless steel heat exchangers, a compressor to increase plant refrigeration by 200 tons daily, a new boiler and 20 brine carbonating towers. It is hoped that the new facilities will be in operation by early fall. West End Chemical Co. is one of the two large soda ash producers in the West.

In the West End process, limestone is calcined with coke to produce a byproduct lime and CO_2. The gas is used for carbonating brine from the lake wells under such conditions that sodium bicarbonate is precipitated. The filtered, carbonated brine is mixed with raw brine, thereby converting the more acid borates to tetraborate, which is processed to produce both anhydrous and crystallized decahydrate borax. The bicarbonate is calcined to produce dense ash, with the CO_2 recycling back to the carbonating towers.

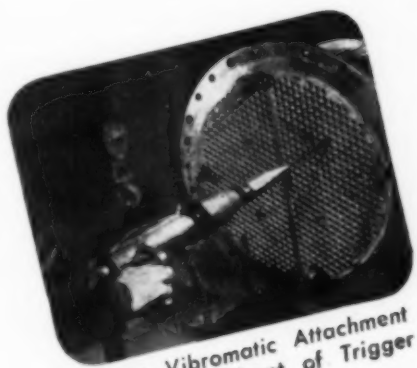
INSECT CONTROL WARFARE MUST BE INTENSIFIED

Only eternal vigilance can now prevent epidemics of new insects and insect-borne diseases in California from foreign sources, according to Dr. Dwight Pierce, entomologist, at the recent California conference of pest control operators. Six different species of mosquitoes were recently found in a shipment of tires from New Guinea, and airplanes from Saipan have been found to carry mites. Returning cavalry horses can introduce sleeping sickness, and a South American disease which affects the human



None better than the WILSON TRIGGER POWER

and we can back that up!



Wilson Vibromatic Attachment in place on front of Trigger Power Tube Cleaner.

Close-up of finger-tip "trigger" control.

The claim is a strong one, we know. It is based on this premise: The trigger power tube cleaner can be called best only if it will clean your heat exchanger tubes quicker, more thoroughly and with greater economy than any other outside suspension cleaner.

And we can back up that claim, because the Wilson Trigger Power tube cleaner does just that! It is the only tube cleaner with which it is economically practical to remove deposits from completely plugged tubes *without damage to the tube walls.*

The reasons for such performance? Here they are — all exclusive with Wilson:

1. Wilson Trigger Power has higher torque at any speed than any other tube cleaner. This cuts down-time radically which means production dollars saved.
2. The unusually fast action of Wilson Trigger Power (up to 3500 rpm working speed) permits the use of standard Wilson accessories, such as: expanding brush, expanding cleaner, etc.
3. Wilson Trigger Power permits a choice of any scavenging agent . . . even cool oil can be used where it is economically available.
4. The Vibromatic Attachment, which delivers 1900 pulsations or "taps" per **minute**, enables the cutter bit to get a "bite" on the deposit even when cleaning tubes completely plugged with flint-hard carbon or rock-like deposits.
5. You can use the Wilson Trigger Power even on sagged tubes. The hollow shafting has sufficient "give" to follow the contour of the sag without damaging tube walls.
6. The Wilson Trigger Power provides the operator with instantaneous, finger-tip control of speed and power.

These features are your assurance that you will get the kind of tube cleaning you want — the kind you *need* for full economy and long tube life.

Wilson Trigger Power tube cleaners are now available from stock. Or, if it is additional information you seek, write for our bulletin today. Address department A.

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WILSON TUBE CLEANERS

heart can be transmitted by giant bedbugs found on foreign pack rats.

New insecticides to combat these and similar pestilences were listed by Dr. A. M. Boyce of the University of California. DDD, a United States modification of DDT, offers promise since it is much less toxic to humans than DDT. The British-developed insecticide 666 or benzene hexachloride is one of the most promising of the new organic insecticides. A chlorinated hydrocarbon called Velsicol 1068, whose organic structure is still uncertain, is reported to be 3-4 times as deadly to houseflies and twice as poisonous to potato beetle larvae as DDT. Dr. Boyce told of two new poisons for killing rats which, with termites and moths, are the most costly pests in California: Antu or alpha-naphthyl thiourea and "1080" or sodium fluoracetate. Antu kills by drawing body liquids into the rats' lungs, causing death in the same manner as drowning. The fluoracetate is so poisonous to warm-blooded animals that its distribution will be severely restricted.

CARBONIC GAS AND DRY ICE PLANT UNDER WAY

CARBONIC gas and dry ice will be produced in a new $750,000 Berkeley, Calif., plant on which foundation work was recently begun by Pure Carbonic, Inc. The plant, which will be erected adjoining the firm's present factory, will provide six times the production capacity of existing facilities. It will house factory, offices and garage for a fleet of trucks to operate a distribution system covering all of northern California and part of Nevada. The plant is expected to be completed next fall.

STANDARD OF CALIFORNIA LEASES RFC REFINERY

A PORTION of the government-owned 100-octane refinery near Bakersfield, Calif., will be leased by Standard Oil of California, San Francisco. Designed for production of 3,000 bbl. per day of 100-octane gasoline, the plant consists of a reforming unit, gas concentration unit, isomerization facilities, HF alkylation unit and isopentane splitter. Approximately one-third of the facilities will be operated by Standard and the remainder will be maintained by the company for the Reconstruction Finance Corp.

Formerly operated by Mohawk Petroleum Corp., the plant has been declared surplus by RFC. Standard's lease is for a minimum of two years, subject to cancellation by either party on one year's notice.

TWO NEW GLASS CONTAINER PLANTS ANNOUNCED

Two new plants for producing glass containers are now under construction in California, according to recent reports. The first is that of Hazel-Atlas Glass Co., which purchased 17 acres of land in Pomona on 5 acres of which the new plant will be built. This unit will manufacture glass containers primarily for food purposes. Investment is reported at $1,250,000 and 300 people will be employed. J. R. Carnahan in San Francisco is in charge of the firm's western activities, which includes a manufacturing plant at Oakland, Calif.

In addition, Ball Bros. of Muncie, Ind., has acquired 30 acres of land in El Monte

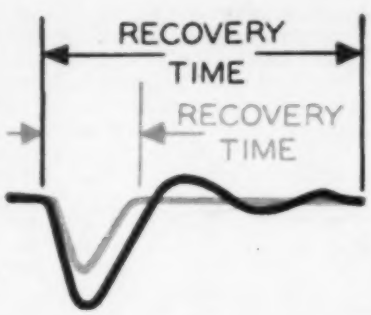
INSTINCTIVE BALANCE

to the rescue!

If you're way out on a limb when a bee attacks, you need more than ordinary balance. It's a situation that requires *extra* action, *fast*. Nothing less than the spontaneous effect of *instinctive balance* can save you from a nasty fall.

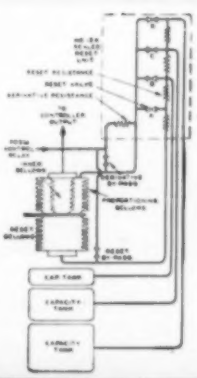
In much the same way, upsets in critical industrial processes are kept in check by HYPER-RESET – a remarkable function of Foxboro's *Stabilog Control*. Sensitive not merely to the *amount*, but also to the *rate* of disturbance, HYPER-RESET Stabilog Controllers apply corresponding corrective actions simultaneously. The result is recovery from disturbances in as little as one-fourth the usual time, with the degree of upset held to new minimums.

HERE'S HOW MUCH DIFFERENCE HYPER-RESET MAKES



The longer, more involved curve shows recovery time in a typical process before the development of HYPER-RESET. The shorter, simpler curve shows how rapidly and smoothly the HYPER-RESET function stabilizes the same process. Usual recovery time is cut by as much as 75%.

Such improved process control may be just the additional edge you need in today's competitive market. Write now for full information on Foxboro's Stabilog Control with HYPER-RESET. **The Foxboro Company, 16 Neponset Avenue, Foxboro, Mass., U. S. A. Branches in principal cities.**



Why HYPER-RESET Requires Only 1 Adjustment

An exclusive practical advantage of the HYPER-RESET Stabilog Controller is its simplicity of manipulation. The patented HYPER-RESET feature provides simultaneous setting of both the reset and rate-sensing functions.

A definite pressure drop across the derivative resistance for every rate of change in the measuring system produces an extra increment of correction.

Only one adjustment is necessary because each reset adjustment valve connects the derivative resistance to a different capacity in the network. (See diagram at left.) Since the proportioning system is automatically self-balancing, the use of a derivative resistance requires a greater quantity of air to maintain equilibrium. In producing this greater flow, a different pressure drop is established by each adjustment. Hence, the effective value of the fixed derivative resistance is really dependent upon the capacity in series with it – and requires no independent adjustment.

FOXBORO Stabilog Control

REG U.S. PAT. OFF.

on which to erect a factory to produce fruit jars and other glass containers. The first unit of this plant will have an estimated cost of $1,000,000 but provisions will be made for expansions at a later date. Hugh Crawford will be Pacific Coast manager, according to reports.

The new plant of Glass Containers, Inc., subsidiary of Fibreboard Products, Inc., at Antioch is about ready for capacity operations. This firm also operates a glass container plant near Los Angeles. Owens-Illinois Pacific Coast Co. has recently indicated an expansion at its glass plant in Los Angeles and possibly also at its plant in Oakland, Calif. Northwestern Glass Co., Seattle, only glass producer in the Northwest, has installed an electric furnace of new design. All these moves emphasize the growing importance of the West as a consumer of glass, particularly of glass containers for food and beverages, and of soda ash, silica sand, salt cake and other raw materials used in glass manufacture.

ZEOLITE MANUFACTURED BY LARGEST SOFTENING PLANT

For the past six months the largest water softening and filtration plant in the United States has been manufacturing its own requirements of synthetic zeolite. The plant, that of the Metropolitan Water District of Southern California near La Verne, Calif., was placed in operation during mid-1941. In the early part of 1945, since the war had made zeolite practically impossible to obtain, District engineers proceeded to build a plant from machines and operating equipment made in the machine shop at the softening plant.

Raw materials used in the process are sodium aluminate and sodium silicate solutions made up in 250-gal. batches. When the batches are prepared, each solution is run into its reservoir tank on a mixing gantry on rails which straddles the drying area; this consists of 14 panels, each having an area of 400 sq. ft. When the gantry is above the panel selected for that particular batch, the two solutions are dropped simultaneously from the reservoirs into the 600-gal. mixing tank mounted on the frame of the gantry and provided with a high-speed stirrer. After being mixed for 30 seconds, the solution is drained into the drying area where it remains until properly cured. Harvesting the dried zeolite is done by means of a suction lift. It is collected in cloth sleeves within the vacuum chamber. After screening, the gel is ready for use in the softening process. Cost of production by the District is claimed to be about half the price of the zeolite available for purchase.

SPOKANE MAGNESIUM PLANT MAY OPERATE AGAIN

Plans for getting Spokane's government-owned Mead magnesium plant back into production are getting under way, it was recently revealed. The plant, designed to produce annually 24,000 tons of ferrosilicon and 24,000 tons of magnesium by the ferrosilicon process, was operated a short time during the war for this purpose by Electro-Metallurgical Co. At the end of the war, this firm was just beginning to operate the plant for the production of metallic sodium and metallic calcium was

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Molecular Weight	96	110	110-120
pH of 1% Solution	1.05	1.10	1.15
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Color	Yellow	Light Amber	Amber

Available in ½ and 1 pound packages, prices on request. Methane and ethane sulfonic acids are in limited supply—mixed acids available in larger quantities.

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reported to be under consideration, but the unit is now being maintained only on a standby basis with a working force of about 40 employees.

Electro-Metallurgical Co. has indicated to the War Assets Corp. its desire to open negotiations for operation of the plant, according to reports, but engineers familiar with the light metals industry doubt that magnesium will ever be produced in the unit. Meanwhile, government engineers have made a complete study of possibilities for producing cyanamide, fertilizer and ferrochrome in the plant.

ELECTROLYTIC IRON PLANT TO BE BUILT IN TACOMA

SELECTION of Tacoma as location for the Tacoma Powdered Metals Co., Inc., a newly formed organization which will produce powdered iron from scrap steel by an electrolytic process, was announced during mid-March. Construction work on a plant will start as soon as labor and materials become available; initial plant installation is expected to cost approximately $500,000 and to require 50-75 employees. Officers of the new organization, Frank Eichelberger as president and Jacob Schoder of Chicago as vice president, are nationally known metallurgists and engineers.

The Eichelberger process, said to be different from that employed at any other powdered metals plant, consists essentially in dissolving the scrap steel in hydrochloric acid and electrolytic deposition of pure iron on the cathode of the cells. After further physical treatment, the deposit is washed, dried, screened and sealed in airtight containers to prevent rust. The product will be shipped east where the only plants now equipped to use powdered iron are located. Factors which decided the company to locate in Tacoma included low-cost electric power, ample supplies of hydrochloric acid, a supply of hydrogen now largely discharged as waste by two chemical plants, and quantities of scrap steel which for many years has been cheaper on the Pacific coast than in the east.

Powdered iron, a comparatively new development greatly advanced during the war, is regarded by many engineers as one of the most promising materials in the field of powder metallurgy for the molding of small, high-precision machine parts. With the new improvements in techniques of precision molding and heat treating, powdered iron will probably be used on an increasing scale for production of automobile and other small machine parts otherwise requiring expensive tooling operations.

IDAHO SUPERPHOSPHATE OUTPUT STILL EXPANDING

ADDITIONAL production facilities that will raise the output of normal superphosphate fertilizer at Simplot Fertilizer Co., Pocatello, Idaho, to the neighborhood of 200,000 tons annually are now being planned, according to officials of the firm. New equipment will include a second Sturtevant acidulating den and another bagging unit. As nitrogenous materials become more available, the firm plans to supply more ammoniated and complete fertilizer.

Although built and first operated during 1944, the Simplot superphosphate plant was

St. REGIS PACKAGING SYSTEMS

prove their worth . . . in SALT

This fourth case history, in a series of MULTIWALL success stories, relates the experiences of one of the leading American salt refining companies. The multiple problems of caking, contamination, and absorption of odor were solved and economy in packaging was effected after consultation with St. Regis field engineers. As a result, this large salt refinery has been a satisfied user of Multiwall Paper Bags and St. Regis Valve Bag Packers for over ten years.

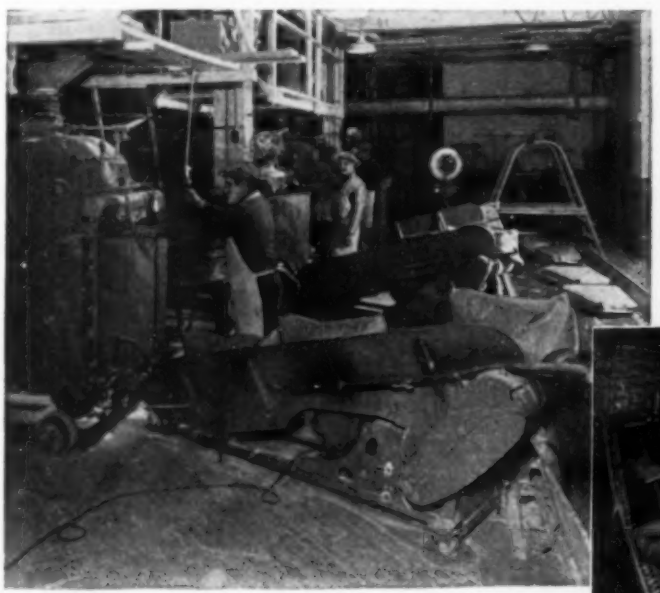
PROTECTION: The multiple layers of kraft paper combined with a moisture proof sheet prevent penetration of water and atmospheric moisture and keep the salt clean and free from caking. No longer is there any problem of lint and dirt in the salt.

REDUCED CONTAINER COSTS: A 46 per cent saving in bag cost has been made by using Multiwall Paper Bags instead of fabric bags.

INCREASED PRODUCTION: An increase of 18 per cent per hour in packaging output, with the same crew, was made possible through use of Multiwall Paper Bags and St. Regis Valve Bag Packers.

EASIER HANDLING: Small portable conveyors running from each of the valve bag filling machines deliver the 100-lb. bags to a large master conveyor on which they ride to the shipping room.

CONSUMER PREFERENCE: Customers express satisfaction with the Multiwall Bag because it protects the product in transit and while stored and eliminates the danger of the salt absorbing odors from other commodities.



Left: *Operators filling 100-lb. Multiwall paper bags using St. Regis Valve Bag Packers. Machine deposits filled bags on small portable conveyors.*

Below: *From small conveyors illustrated on left filled bags are delivered to this master conveyor which delivers the 100-lb. bags to the shipping room.*

St. Regis MULTIWALL PAPER

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expanded in 1945 to provide additional storing and curing space to double the output. A crushing plant for phosphate rock was also installed since rock dust from outside sources proved inadequate for maximum output. The two mills will grind mine-run phosphate to 90 percent through 100-mesh screen at the rate of 4 tons per hr. each. Phosphate rock for the plant is obtained from mines near Conda and Montpelier, Idaho, while sulphuric acid requirements are normally supplied by Garfield Chemical & Manufacturing Co. from Garfield, Utah.

State quotas of phosphate fertilizers which Simplot Fertilizer Sales Co. anticipates filling during the current year are as follows, in tons: Washington, 25,000; Oregon, 15,000; Idaho, 20,000; Utah, 7,000; Wyoming, 5,000; Colorado, 10,000; Nebraska, 5,000.

BASIC RESEARCH PROGRAM MAPPED BY UTAH

REALIZING that more intensive research is necessary for fuller development of industry and agriculture, the State of Utah is now launching a basic, long-term research program to include and integrate the fields of geological mapping, mining, chemical and metallurgical industries, economics, agriculture and land reclamation. The program, now being organized by Dr. J. R. Mahoney, director of the Bureau of Economic and Business Research of the University of Utah, is sponsored by the Utah State Department of Publicity and Industrial Development, the U. S. Geological Survey and the University of Utah. An initial budget of $40,000 provided equally by the University Research Fund and the Geological Survey has been earmarked for organizational and initial work during the first fiscal year.

Chemical, metallurgical and industrial aspects of the program will largely be represented by an expansion of the present university activities integrated by detailed economic and feasibility studies. Of major interest to the chemical industries will be that part of the 30-year Geological Survey mapping program that will be devoted to a detailed study of the Bonneville Basin. This area, one of the largest saline chemical deposits in America, has received so little study that the nature and extent of the individual chemical constituents of the deposits and brines are still largely unknown.

LIGHT AGGREGATE PROCESSED FROM OBSIDIAN ROCK

AFTER a number of years of experimental work, a process of exfoliating or "popping" the soft obsidian rock often misnamed pearlite (or perlite) has been put into operation by Fluftrok Corp., Reno, Nev. At present the only commercial producer of the material, the firm's $200,000 processing plant at Mason, Nev., began operations about six months ago after extensive pilot plant runs. Source of the rhyolitic obsidian glass used as raw material is an extensive deposit near Yearington, Nev. When heated in suspension at the proper temperature and conditions, the rock expands up to 16 times its original volume to form a very porous, white light-weight material that floats indefinitely on water and analyzes about 80 percent silica. With 10 percent cement, the material becomes suitable as a lightweight

aggregate for building blocks that are extremely light yet show strengths up to 2,000 lb. per sq.in. Many industrial uses for the calcined rock have been suggested.

A recent and improved type of kiln just now starting operations is expected to reduce processing costs of the material still further and to eliminate the old-type rotary kiln previously used. The present burner can produce about eight cars daily of expanded rock; a second unit is now being added. Developer of the process is P. G. Means, who is also president of Fluftrok.

IDAHO GROUP PLANS CHEMURGY ADVANCES

THE STRIDES Idaho has made in the science of chemurgy were detailed at the recent annual meeting of the Idaho committee of the National Farm Chemurgic Council. Discussion of potato starch manufacture was highlighted, as it represents Idaho's first attempt at industrialization and utilization of cull potatoes, normally a waste product. Idaho has four of these white potato starch plants, all established since 1941, which have been supplying more than 50 percent of such starch consumed in the United States. These plants, built at Twin Falls, Blackfoot and St. Anthony, were made of "junk parts," and it was reported that production costs could be reduced by installation of new equipment and reduction of processing time.

A $100,000 research program has been organized and the Idaho Research Council, headed by Dr. L. C. Cady, acting dean of the college of engineering, University of Idaho, Moscow, is now conducting work on noxious weed killers, use of gums and resins for secondary trees, benefication of phosphate rock and soil stabilization. A new process for purification of sugar beet juice to make sirup and an operation whereby amino acids may be obtained from beet waste were reported to be under development by Amalgamated Sugar Co. Idaho growers produced 220,000,000 lb. of sugar from beets in 1945. It was pointed out that residue pulp from the manufacture of starch can be used for livestock feed or converted into glucose, sirup or alcohol.

Windsor J. Lloyd, Nampa, was reelected chairman of the Idaho committee, with George Crookham, Caldwell, as vice chairman and R. E. Gale, Boise, as secretary.

NORTHWEST MAGNESITE LEADS REFRACTORY PRODUCTION

WITH several mines and a calcining plant at Chewelah, Wash., Northwest Magnesite Co. continues to be the largest domestic producer of refractory magnesia, according to a recent report of the U. S. Tariff Commission. After pilot plant experiments in 1939, selective flotation equipment for beneficiating ore and new calcining facilities were installed at the Chewelah plant at a cost of over a million dollars, more than doubling the company's capacity to produce refractory magnesia. Of the total output at this plant, maintenance grades have recently accounted for 80-90 percent. The company also acquired the right to use the British-controlled Chesny process for production of refractory magnesia from sea-water and dolomite and its new plant at Cape May, N. J., has an annual capacity of about 35,000 short tons by this method. Northwest's production

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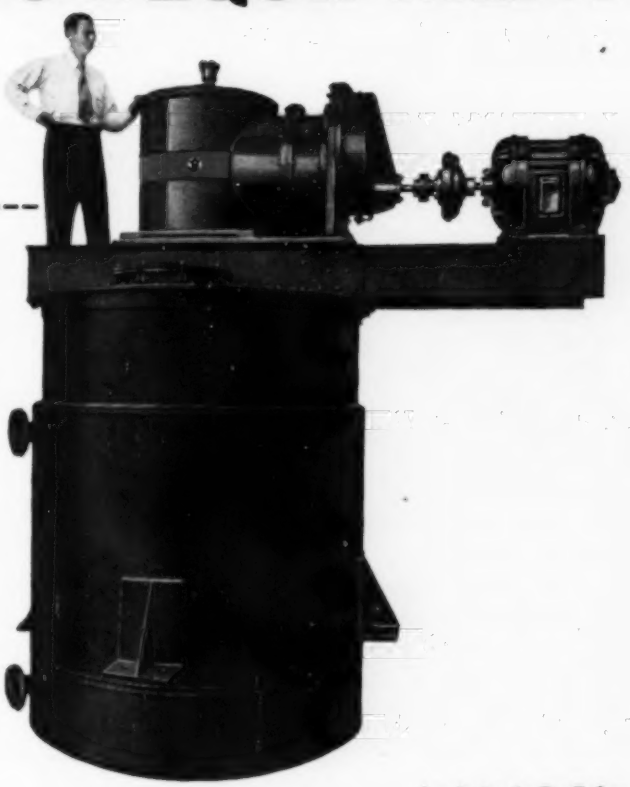

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If Production Is Holding Up Your Orders— Remember I·P·E Delivers Equipment On Time

IF YOU ARE flooded with post war orders . . . if even full time production finds you unable to keep up with your orders, consider this: have I·P·E analyze your production process—make suggestions that will help you step up output through the addition of new process equipment.

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of refractory magnesia from all materials in 1944 amounted to approximately 65 percent of the total domestic production as compared to about 90 percent for the immediate prewar period. Its wartime investments account for nearly half the total new investments in the entire industry.

About 75 percent of the crude magnesite produced in the United States in the prewar period came from Washington, and Northwest has continued to control the production of crude magnesite and dead-burned magnesia in that state. Very little magnesite is transported; the bulk is calcined at or near the mine.

California magnesite deposits, second in importance to those of Washington, were rapidly being exhausted during the war but Nevada, with vast deposits, has recently become an important source. Westvaco Chlorine Products Corp., Newark, Calif., continued to be the only producer of periclase-grade magnesia from one mine in the state. This firm's relatively small production of other refractory magnesia comes from two sources—sea-water bitterns and crude magnesite. The most significant change in the industry during the war has probably been the opening by Permanente Metals Corp. of a sea-water magnesia plant at Moss Landing, Calif., and the recent erection nearby of a plant by Permanente Cement Co. to produce refractory brick. This plant is reported to have a capacity of 100 tons daily of high-purity periclase brick.

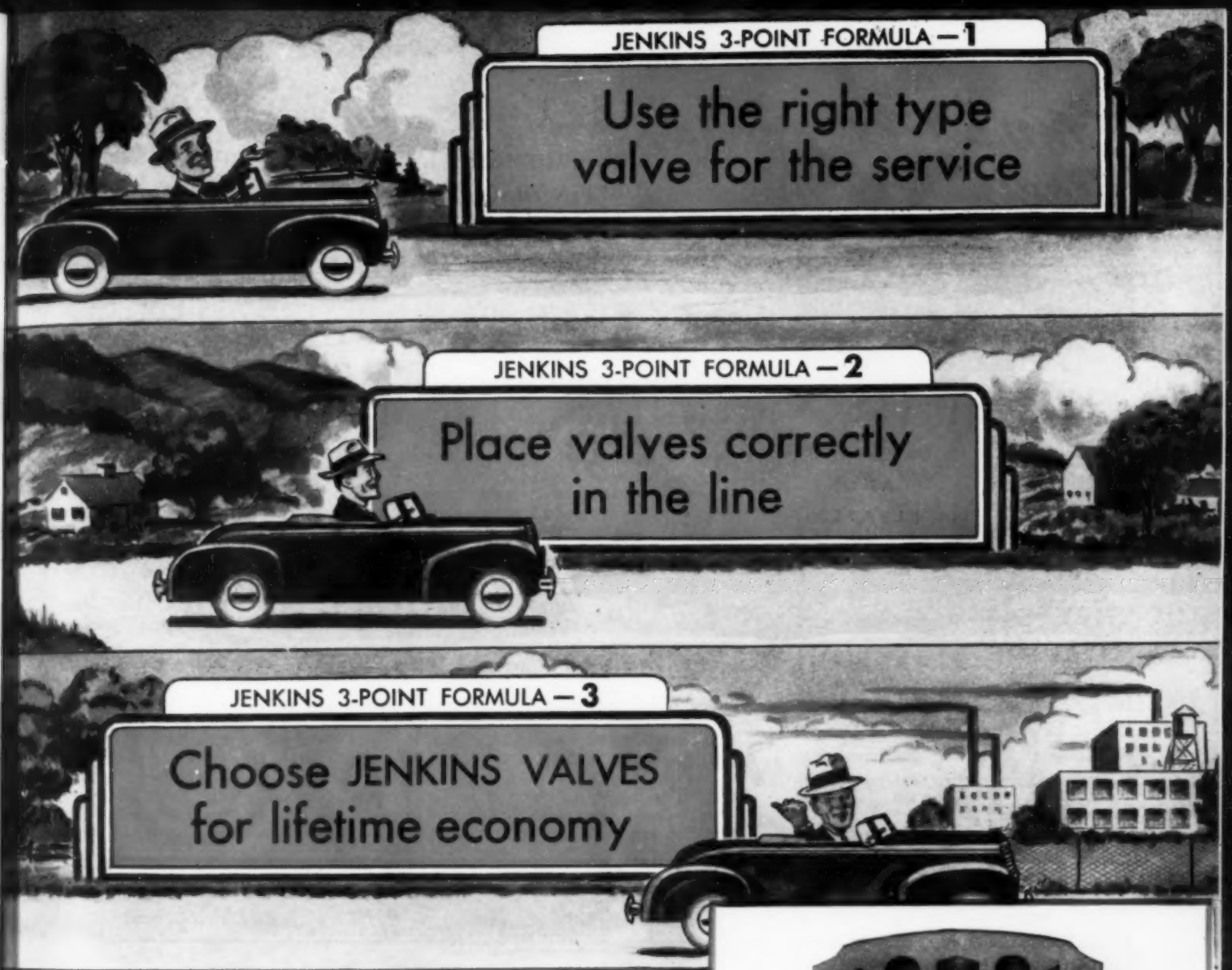
PRIVATE INDUSTRY TAKES OVER RFC PLANTS

INDUSTRIAL plants constructed and financed by government agencies for wartime operations are now being sold or leased to private corporations and individuals. Recent information released by the War Assets Corp. on sales and leases for the eleven western states is tabulated below. (See *Chem. & Met.*, Jan. 1946, pp. 188, for a complete listing of such plants.)

Sales and Leases of RFC Industrial Plants and Sites

War Operator	Plant Location	Original Product	Rated Capacity, Tons	Plant Cost	Sales Price	Purchaser or Lessee
Coast Carbons, Inc.	Tacoma, Wash.	Wood charcoa	450/mo.	$121,230	$24,000	Earl Rowe
Molybdenum Corp. of America	Empire, Colo.	Molybdenum concentrate	——	351,503	951,503	Molybdenum Corp. of America
Westvaco Chlorine Products Corp.	Newark, Calif.	Calcined magnesia	100/da.	287,354	72,000	Westvaco Chlorine Products Corp.
Basic Magnesium, Inc. (portion)	Henderson, Nev.	Magnesium	——	——	*	Hardesty Chemical Co.
Basic Magnesium, Inc. (portion)	Henderson, Nev.	Caustic soda, chlorine	——	8,478 788	*	Stauffer Chemical Co.
Pacific Carbide & Alloys Co	Tacoma, Wash.	Calcium carbide	1,000/mo.	553,000	*	Independent Insulations, Inc.
Pine Top Asbestos Mine	Globe, Ariz.	Asbestos	——	65,440	**	Globe Arizona Asbestos Co.
Rohn Aluminum & Brass Corp	Los Angeles, Calif.	Aluminum shapes	——	8,205,148	***	Harvey Machine Co., Inc.

* 5-yr. lease. ** 3-yr. lease. *** Tentative approval for lease.



The right road to lower valve costs . . .

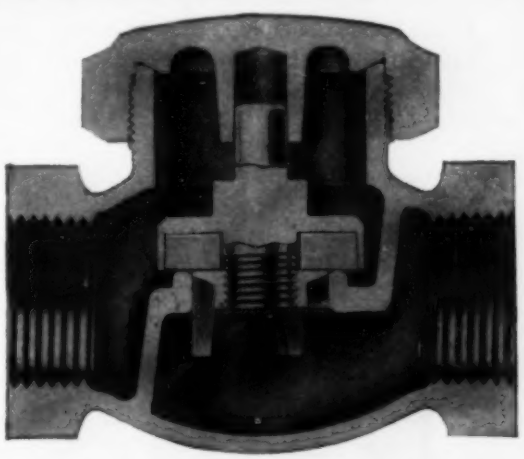
When you follow the Jenkins 3-Point Formula, you can be sure you're headed for new savings in valve expense.

First comes careful selection of pattern and metal. While *many* types *may* be used in a given service, ordinarily there is only *one* type *best* suited to withstand the service conditions and require least maintenance.

Next comes correct installation. Both *where* and *how* a valve is installed can limit or extend its service life, according to the valve "know-how" applied. Write for Booklet No. 944 on installation.

Third, by choosing Jenkins Valves, you not only get valves made with *extra* endurance that means *extra* economy. You also get the experienced advice of top-rated valve specialists, Jenkins Engineers, whenever you need it, on any question of selection or placement.

Base your valve buying on the 3-Point Formula, and make sure of the *extra* value that means *lowest cost in the long run.*



Jenkins Fig. 117-A Bronze Lift Check Valve

Made with a renewable composition disc, Fig. 117-A is dependable choice for drop-tight closure, economical maintenance, and, long, trouble-free service. The disc can be replaced quickly and easily without removing the valve from the line. For pressures up to 150 lbs. steam, 200 lbs. O.W.G.

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NEWS FROM ABROAD

URGENT HOME DEMANDS LIMIT BRITISH EXPORTS BUT FOREIGN TRADE IN CHEMICALS IS RISING

Special Correspondence

BRITAIN'S EXPORT drive is about to grow into a production drive covering the whole field of industrial activity. The export trade still ranks as priority No. 1, but in some sectors a new rival for the country's output of industrial products is claiming even higher priority grading. With the end of the winter the building season has started, and soon huge quantities of various materials will be absorbed into new houses to replace those destroyed during the war.

Further, a spread of home demand for consumers' goods can no longer be checked by appeals for austerity and economy alone. The time has come for a revision of wartime policies for curbing consumption, but the country's resources are not equal to the three-fold task of expanding exports (to pay for imported food and raw materials), of producing more consumers' goods (to offer the worker a reward for hard effort), and of building more houses, plants and machines (to make up for wartime losses and omissions) at the same time.

To do justice to all three tasks, a large over-all increase in production and, since manpower is limited, in productivity is needed. It is sought on the road of co-operation between government, industry and workers and may well be obtained in this way. It is clear, however, that with the country's economic resources of plant, power, labor and raw materials strictly limited careful planning will be needed to achieve maximum results. In the chemical industries, more particularly, constant adjustment of supply and demand, continuous attention to the distribution of deficiency commodities among competing buyers, and utter economy in the use of fuel and labor will be required. It is true that chemical manufacturers have so far escaped interference by government departments. No chemical trades, with the exception of the coke-oven and coal-tar industries, are scheduled for nationalization. The de-control of chemical materials has proceeded at a satisfactory pace. None of the Working Parties appointed to investigate shortcomings in business methods have to deal with any chemical production. By their successful part in the export drive, British chemical manufacturers have indeed proved their efficiency and enterprise to the satisfaction of the authorities.

The country-wide production drive, however, will create entirely new problems. It will, in the first place, necessitate a reorientation of export policy. Some classes of goods will have to be virtually withdrawn from the export market, while shipments of

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Units are precision built from the materials selected to suit the particular process requirements, resist corrosion or prevent product contamination. The result is more efficient equipment for producing higher quality products with lower operating costs.

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others will be encouraged by all means. The paint trade, for instance, has raw materials for export orders only to the value of £540,000 in January-March, while foreign orders on the books of paint manufacturers early in January totalled £3,000,000. The discrepancy was largely due to shortages of drying oils and pigments.

In future, domestic building is likely to reduce further the amount of paints available for exports. In the cosmetics trade, on the other hand, the government hopes to stimulate exports by increasing raw material supplies for the home market. Manufacturers of toilet preparations and perfumery were told that additional home trade quotas would be given to them proportionate to the value of their exports in 1946, on condition that the industry's total exports would rise by 60 percent between the first and fourth quarters of this year. Thus cosmetics makers will pay directly by bigger exports for the cost of foreign raw materials for their home market output.

Chemical exports as a whole continue their upward trend. They are now running at about three times the prewar value. Their volume has doubled as compared with 1938. This expansion is largely due to the re-opening of old markets which had to be neglected during the war. It was made easier by the exhaustion of stocks in overseas importing countries and by the absence of competition from continental Europe. The principal buyers of British chemicals are still India, Australia and other Empire markets, Egypt and Argentina, while in Europe France and Spain are so far the only important buyers of British chemicals.

The United States is still among the leading buyers, but a decline in British chemical shipments to the States has occurred since the wartime peak period. If, as expected, shipments abroad of inorganic chemicals, dyestuffs, drugs and cosmetics continue to increase while those of paints, fertilizers and coal-tar products are kept in check by a proportionately bigger and more urgent home demand, the direction of Britain's export trade in chemical and allied products is unlikely to be affected to any marked extent.

FERTILIZER EXPANSION

British fertilizer consumption has undergone a heavy expansion during the war, and there is every prospect that it will continue to advance. The increase, though easily explained by the need for more home-produced food and the prosperity of farmers, is indeed striking. Despite wartime difficulties of shipping, the consumption of phosphate rock for fertilizers rose from 26,300 long tons a month in 1935 to about 60,000 tons in 1945. The consumption of superphosphates increased accordingly from a monthly rate of 42,800 tons in 1935 to over 80,000 tons in 1945, while that of basic slag advanced from 24,000 tons monthly in 1937 to more than 45,000 tons last year.

The supply position for potash has not improved to the same extent; less than half the potential demand can be covered at the present rate of importation. Similarly, the consumption of some types of nitrogenous fertilizers would have been higher had bigger supplies been available. There has been a substantial advance in the use of synthetic nitrogen compounds, but there is no doubt that British agriculture could usefully absorb

ENGINEERING PROGRESS REPORT # 2

LJUNGSTROM AIR PREHEATER

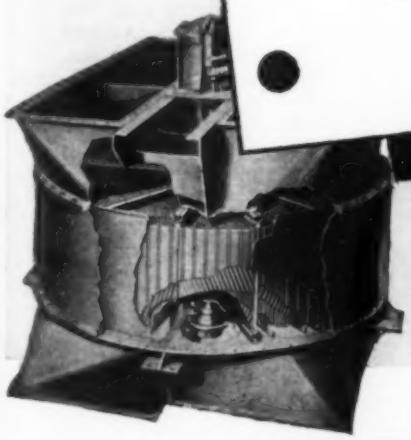
Economics of Fuel Saving by Lower Exit-Gas Temperatures

Mounting fuel costs stress the importance of savings made by lowering exit-gas temperatures, and thus increasing heat recovery. Problems arising from lower exit-gas temperatures are being given intensive study.

Progress report one covered control of deposits. Encouraging progress is being made toward the reduction of corrosion. At the present time, while it is not possible to eliminate corrosion, it can be held down to a low rate.

This leaves the entire subject of lower exit-gas temperatures on a strict dollars-and-cents basis. With the mass blower in use, increased draft loss caused by the deposits plugging up the heater is no longer a factor.

An exclusive feature of the Ljungstrom air preheater provides for rapid and inexpensive replacement of the elements at the cold end.



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more home-produced as well as, of course, imported natural nitrates. It is difficult to predict how this will affect the external commerce in chemical fertilizers, but as the shipping position has eased and more Chile saltpeter and other products can be imported, an attempt will certainly be made to ship larger tonnages of the fertilizers of which Britain is a surplus producer.

CHEMICAL EXPORT QUOTAS

If, as a government spokesman stated, the heavy industries are to export one quarter of their total production, the chemical trades will probably have to shoulder an even bigger export quota, and to fulfill this the younger branches of the chemical industry will have to make a bigger contribution than they do today. There is no lack of projects for new factories and plant extensions in the plastics and artificial fibers industry, but the bigger firms are hampered by the lack of construction materials and complain about delays in official handling of applications for building licenses and other permits.

Smaller firms with less ambitious projects may find it easier to obtain official sanction for their plant projects and do not meet insuperable difficulties in procuring labor and materials for new production schemes, but big companies seem to experience serious delays. A good illustration of their predicament is provided by some figures in the latest annual accounts of Courtaulds, the big rayon producer. This company sets aside £457,000 for deferred repairs and renewals which were due in 1945, since the amount actually spent on such work, viz. £102,000, was in respect of repairs and renewals which should have been carried out in previous years. The difference between the actual expenditure and what is considered necessary gives an idea of the arrears accumulated during the war.

Manufacturers of chemical plants and apparatus will also have to divide their attention between home market and export orders. The delegation of Indian chemical manufacturers which toured Great Britain and the United States returned with the impression that "American manufacturers of plant and machinery are in no way better in the matter of deliveries than firms in the United Kingdom," but this is cold comfort for British chemical firms wishing to buy new plants. They are forced to make do with the apparatus and machinery they have got.

The conversion of existing wartime plant to different peacetime uses has been developed to a fine art. Firms wishing to set up new works are helped by the disposal of armament factories and development of "industrial estates." One of the latter, near Glasgow in Scotland, will house four smaller factories for Chemicals, drugs and pharmaceuticals.

Recent allocations of government factories to private firms include several to be used for making plastics, laboratory chemicals, and other fine chemicals in different parts of the country. In addition, several plastics makers have made separate arrangements for new factories to facilitate the extension of their production range.

Quite a number of such small and medium-sized production projects have become known during the past few months, so that perhaps the first tentative conclusions can be drawn concerning the trend reflected

The importance of specialized shop facilities for pipe fabrication is demonstrated convincingly by this Grinnell-developed extruding machine.

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WHENEVER **PIPING** IS INVOLVED

by these new factory schemes. The new plants are dispersed over the whole country, thus avoiding the mistake committed in the past of industrial congestion in a few areas with consequent transport and labor troubles. There is no evidence of a trend towards specialization; on the contrary, in such new fields as plastics the leading manufacturers are obviously endeavoring to spread their activities both horizontal and vertically.

Another feature of new production schemes is the participation of U. S. companies in some new ventures. A recent development in this field is the formation of British Geon Ltd., a new £500,000 capital company, which is "to adopt an agreement between the Distillers Co. (biggest producer of industrial alcohol in the British Isles) and B. F. Goodrich Chemical Co. of Cleveland, Ohio," to make resins and plastics. It would not be surprising if the next few months would bring more examples of such international cooperation in new industrial ventures.

TECHNICAL UNIVERSITY OPENS IN SAO PAULO, BRAZIL

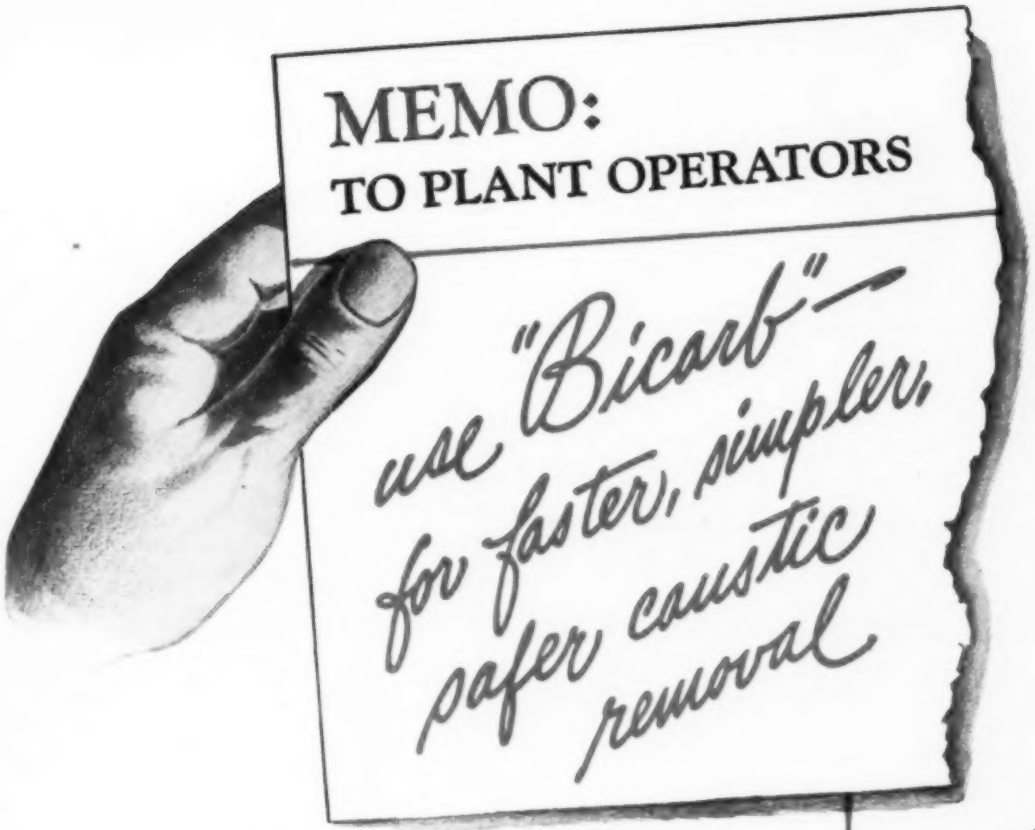
OPENING last February of the department of industrial chemistry as the first unit of the School of Engineering at Sao Paulo, marks an innovation in Brazilian technical education since it enables students to take a university course in engineering, chemistry, and related fields immediately after having completed five years of elementary and five years of secondary school. Organized by the Rev. Roberto Saboia de Medeiros, S. J. who visited the United States in 1944 and enlisted the support of prominent industrialists, the university is administered and financed by the Foundation of Applied Sciences, a Jesuit organization.

NEW RAYON PRODUCTION PLANNED FOR CANADA

WHILE apparently still in its preliminary stages, a project looking toward new production of rayon yarn and staple in Canada is said to be under consideration. The report credits a combination of United States and Canadian interests as originators of the project but the United States interests are not identified either as individuals or as representatives of any rayon company. Members of the firm now operating the Dionne Spinning Mills Co. at St. George de Beauce, are mentioned as the interested Canadian parties. The unofficial report is that a new company will be formed to produce rayon in the building which has been used as a government arsenal at St. Malo, close to Quebec.

PATENT SITUATION AFFECTS DEVELOPMENTS IN CHINA

REPORTS from McGraw-Hill World News Bureau state that foreign technicians foresee reluctance on the part of their corporations to risk introducing manufacturing processes in China on an all-out basis unless the Chinese government enacts a law for protection of patent rights. American firms in Manchuria, whose patents came under laws instituted by the Jap puppet regime, stand to lose out now that the area has been regained by China unless the government continues the legal protection. A similar situation is



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While complete details for the utilization of this process have been evolved specifically for textiles, Mathieson Research is prepared to carry out further assignments in other fields.

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faced in Korea and Formosa. Well-known American trade marks which lost protection in Jap-controlled territories during the war include Permutit, Nichrome, Monel, Carborundum Alundum, and Pentode.

ITALIAN PAPER INDUSTRY OPERATES AT LOW RATE

Surveys of the paper industry in Italy have brought out that damage to the plants during the war years was not very heavy and it is estimated that from 80 to 85 percent of paper-making capacity has been left intact. However, the industry has been slow in getting back to normal operations and only a small part of the available capacity is being operated. Recent reports place total production at from 20 to 25 percent of normal.

RUSSIA HAS NEW METHOD FOR PROCESSING OZOKERITE

Press reports from Soviet Russia say ozokerite is now processed in a new plant at Tadzhikistan. Mechanized processing permits the extraction of 75 to 80 percent of the material compared with 20 percent obtained by methods in former use. In Russia this mineral wax is used in treating hides and skins, as a solvent in the manufacture of synthetic rubber, and in dyes and medical preparations.

INDIA HAS SCARCITY OF DYES WITH PRICES HIGH

Prior to the late war, India obtained the major part of its coal-tar dyes from Germany. From 1940 on, Germany has dropped as an exporter and while the United Kingdom, the United States, and Switzerland have increased their shipments, the total supply has been inadequate for all Indian requirements. Prices have been on an upward trend and have more than doubled the prewar levels. India produces dyes only on a small scale. Attempts to build up dye production have not met with much success but an effort is being made to develop a home output of about one-half the country's needs. However it will take a long time to train the highly skilled workers required.

DDT WILL BE MANUFACTURED BY JAPANESE COMPANY

Permission has been given by American military authorities for the manufacture of DDT in Japan. The basic ingredient for DDT will be imported from the United States and it will be mixed with talc obtained from the mines at Sarusawamura, in East Iwai County, Iwate Prefecture. The Japan Steatite Industrial Co. (Nihon Kaseki Kogyo Kaisha) will pioneer in the undertaking.

CHEMICAL SUPPLIES IMPROVE IN MARKETS OF URUGUAY

More plentiful supplies of chemicals placed the chemical and chemical-consuming industries in Uruguay in a more favorable position to start the present year. Imports of sulphur and arsenic were large in the final quarter of 1945 and stocks of anhydrous ammonia also were increased through imports. Dyes continue to be scarce but arrivals eased the situation somewhat. Acetic acid and acetone were other chemicals re-

As the plastics industry grew, Stauffer chemicals kept pace—day to day, year to year—supplying increasing quantities for an increasing industry that seemed to know no bounds. Now, today, the plastics industry stands on the threshold of a new era in production and Stauffer stands with it—ready to keep that pace with dependable chemicals.

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ceived in good volume from the United States and the paint and tanning industries were helped by receipts of sodium bichromate but chrome chemicals still are tight. Potassium chlorate for the match trade was received from the United States and from Sweden.

FRENCH FACTORIES RESUME PRODUCTION OF TIRES

THREE of the largest rubber-manufacturing plants in France, located in the Lyon consular district, were producing 105,000 automobile tires and 530,000 bicycle tires a month at the end of last year. The Michelin plant at Clermont-Ferrand employed 20,000 workers before the war. Now there are 12,000 workers and the output is 80,000 automobile tires and 380,000 bicycle tires a month. The tires are 83 percent synthetic rubber.

The Bergougnan plant is much smaller and employs 2,500 workers with an output of 10,000 tires a month. It also produces tubing and other rubber products. About 5,000 workers are now engaged at the Dunlop plant at Montlucon with the monthly output running 15,000 automobile tires and 150,000 bicycle tires.

SWEDEN OFFERS GOOD MARKET FOR RAW MATERIALS

EXPANSION of industrial operations in Sweden has placed that country in a position where it offers a good market for a varied line of raw materials as well as finished products. In order to make its requirements more widely known a pamphlet giving main facts about Sweden as an import market has been published by the Federation of Swedish Wholesale Merchants and Importers. Before the war Sweden ranked among the 10 first countries in international import statistics with an import value of 183 Scandinavian gold crowns per capita of population. The booklet may be obtained in the United States by applying to Swedish Import Market, 630 Fifth Ave., New York.

PRODUCTION OF COTTONSEED GAINS GROUND IN INDIA

PRODUCTION of cottonseed in India in the 1944-45 season declined to 1,265,000 long tons but this had no bearing on production of cottonseed oil as the bulk of the seed is fed to livestock. Until 1937 there was only one crushing mill in India but in 1944 two large mills operated at the rate of about 100,000 tons of seed a year. In addition there are more than a dozen small-size oil mills in the Punjab which crush more than 100,000 tons of seed a year. Total amount of seed crushed is about 300,000 tons. Practically all the oil is consumed in edible lines, principally hydrogenated and converted into vegetable ghee—a semifluid butter.

CHILE MAKES SHARP CUT IN IODINE OUTPUT

LATEST data on production of iodine in Chile refer to the first half of last year and the figures show the output was on a much smaller scale than that for the comparable period of 1944. For the first half of 1945, production is placed at 371 metric tons while for the January-June period of 1944, production was 643 metric tons.

GERMAN CHEMICAL INDUSTRIES

BERYLLIUM METAL

BERYLLIUM is made on a small scale in Rheinfelden in a cell with a nickel anode and iron cathode. The current used is 500-1,000 amp. The ore is sintered with CaO and extracted with H_2SO_4. The Al and Fe are removed as alums. $Be(OH)_2$ is precipitated with NH_4OH and converted to BeO by calcining. It is briquetted with carbon and then chlorinated. The chloride is electrolyzed in a fused bath with KCl. Be separates in crystallized form and is then melted in vacuum. The Be is used to make 1-2 percent copper alloys.

Digest from "Deutche Gold und Silber Schelde Anstalt, Degussa, Frankfort/Main" OPB Report No. 181 by L. M. White.

ISO-PARAFFIN SYNTHESIS

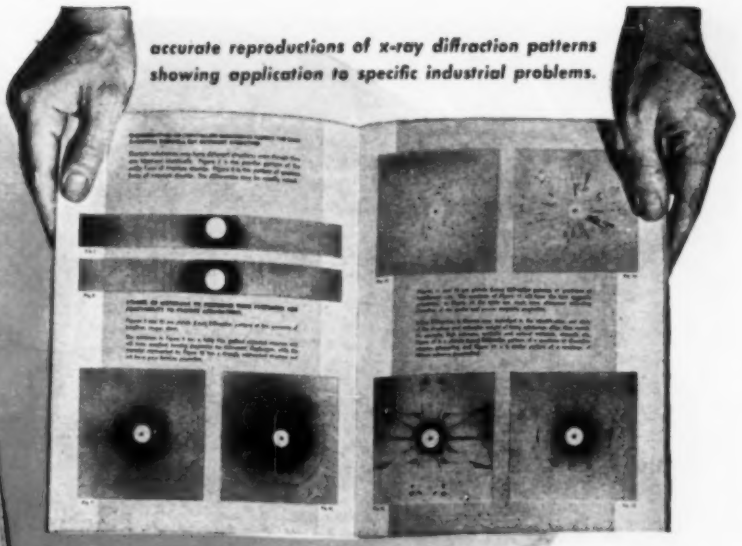
WARTIME research by the Kaiser Wilhelm Institute fur Kohlenforschung on the Fischer-Tropsch synthesis has been primarily directed along the line of iso-paraffin synthesis.

Operating conditions for the synthesis of iso-paraffin have been found to lie in the range of 300 atm. pressure and 420 to 450 deg. C. For pressures under 300 atm. the yield falls off rather sharply, although a very slow reaction will take place at 30 atm. or over. Higher pressures than 300 atm. give increasingly greater percentages of oxygenated products, until at 1,000 atm. the principal product is dimethyl ether. Similarly, lower operating temperatures give slower reaction rates, more unsaturated compounds, a very high percentage of alcohols, and less carbon formation on the catalyst. For temperatures slightly greater than 450 deg. C., the products become principally naphthenic, and carbon deposition becomes excessive. Instantaneous reaction rates, however, are increased.

It has been found that the best synthesis gas has a $CO:H_2$ ration of 1.2 volumes of CO to 1 of H_2. Increasing the hydrogen increases methane formation; decreasing the hydrogen lowers the over-all yield.

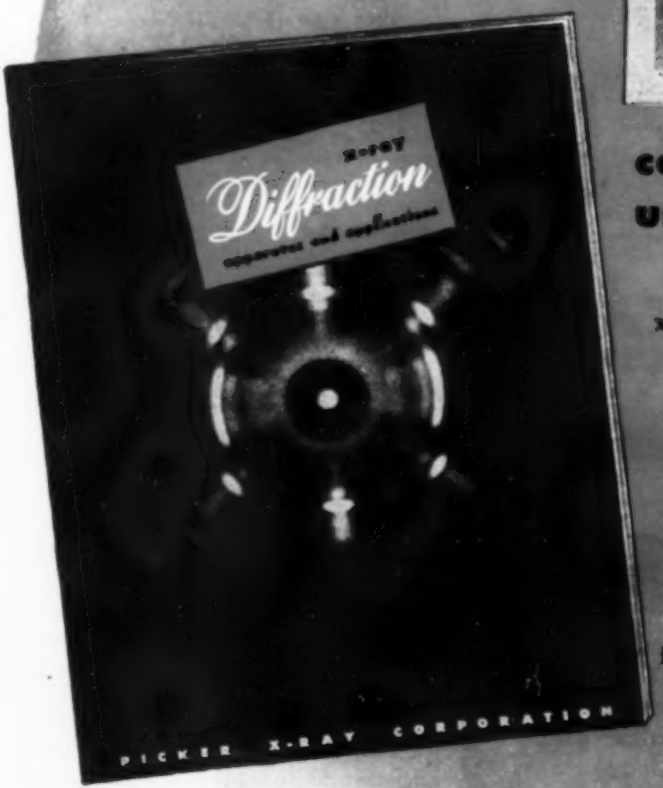
Best catalyst found for this synthesis has been an alumina-thoria co-precipitated one, although $ZnO\text{-}Al_2O_3$ appears to be nearly as good and much cheaper. Using either of these materials it was found necessary to burn off the carbon deposits about every two weeks of steady operation. This was accomplished with air at the temperature of the synthesis. Catalysts so treated have been used continuously for over 6 mo. without appreciable decline in activity. Their heat sensitivity is also quite good, as they have been held for prolonged periods at 800 deg. C. without damage.

Heat evolution during synthesis is approximately the same as with the normal synthesis, i.e. one-fifth of the heat of combustion of the products. Since it is possible to work in a 20 to 30 deg. C. temperature range, this lessens the problem of very close temperature control normally encountered in this process. Another advantage is found in the fact that sulphur does not seem to



accurate reproductions of x-ray diffraction patterns showing application to specific industrial problems.

this helpful guide



can bring you up-to-date on uses of x-ray diffraction . . .

You've heard of the remarkable contributions x-ray diffraction has made to many urgent wartime problems (in the development of synthetic rubbers, use of steel in shell cases, improvements in plastics, among others). Its applications are so diverse that in many plants today x-ray diffraction has become an indispensable routine tool for rapid physical and chemical determinations, research in product improvement and design, studies in waste reduction. This Picker Bulletin No. 1245, just published, discusses many phases of application, types of apparatus, techniques employed. It will be helpful in the evaluation of the method in your own problems. *Send for it today.*

Picker Bulletin No. 1245 is available without cost or obligation. Simply ask for it (on your letterhead, please, to either of the addresses below).

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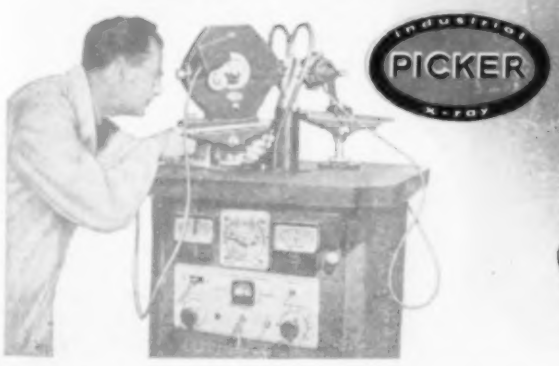
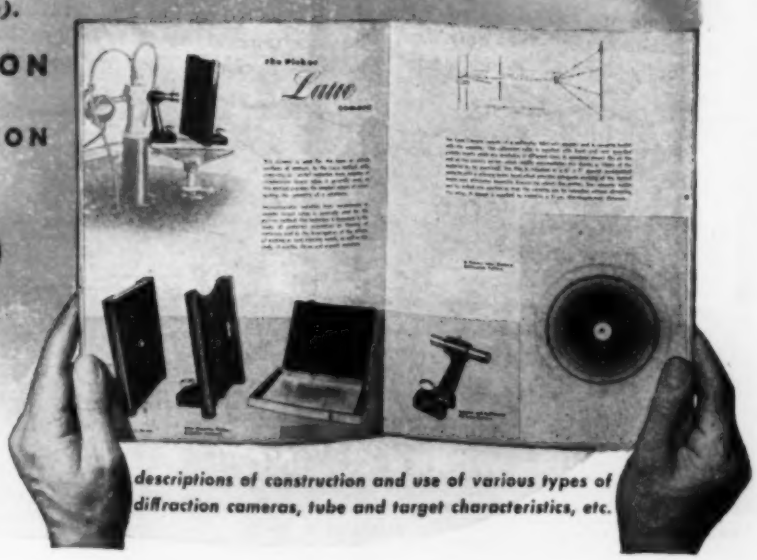




descriptions of construction and use of various types of diffraction cameras, tube and target characteristics, etc.

be nearly as deleterious as in former syntheses, although the upper allowable limit has not yet been determined.

Gas velocities have been fairly accurately studied, and it was determined that 20 c.c. of a 2 to 4 mm. catalyst were necessary for each 10 l. of synthesis gas per hr. Any increase above this velocity gave sharp decreases in yield and also tended to form increasing amounts to alcohols.

Product yields, in g. per cu. m., are as follows from a ZnO-Al_2O_3 catalyst using a CO:H_2 ratio of 1, at 300 atm. and 450 deg. C.:

Total yield of C_3 and higher	120–130
C_3	20
C_4 (90% isobutane)	50– 80
C_5 and higher (over 97% iso)	30– 60

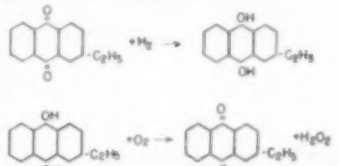
A comparison of the 2 catalysts shows that for a thoria-alumina catalyst (1:4 by weight) the best yields of all are obtained. Higher gas velocities can be used, and there is little tendency to form alcohols. However, there is a greater tendency to form carbon on the catalyst, meaning shorter burn-off times.

The development of the Fischer-Tropsch process as a producer of iso-paraffins, and thus a source of high quality aviation and automotive fuels, opens the way for it to become the most versatile of all synthetic fuel processes. It would then be capable of producing products which range all the way from high quality diesel fuels and lubricants to excellent aviation gasoline.

Digest from "Wartime Research on Synthetic Fuels; Kaiser Wilhelm Institut fur Kohlnforschung" OPB Report No. 289 by D. R. Dewey.

H_2O_2 PRODUCTION THROUGH 2-ETHYL ANTHRAQUINONE

CONVENTIONAL methods of hydrogen peroxide production are all electrochemical reactions involving the oxidation of solutions of sulphuric acid or ammonium sulphate. It has been known that reactions involving the oxidation of easily oxidizable organic materials and the extraction of the resulting peroxide with water could be used. The process described here had been operated successfully at Ludwigshaven for several months before it was bombed out. The plant had a daily production of one metric ton of H_2O_2 calculated on 100 percent H_2O_2 basis. The chemistry of the process was:



In the unit the total working solution was 15 cu. m. of which one-quarter is in the reductor, one-quarter in the oxidizer, and one-half in the other vessels. The total time for circulation is 2 hr. The main difficulty is the first reaction. This is carried out by passing hydrogen through the quinone in a solution of 50 percent thiophene free benzene and 50 percent cyclohexanol in the presence of Raney nickel. It is preferable to use higher aliphatic alcohols (C_7-C_{11}) if possible. The process is carried out in nine steps, as follows:

Precontactor—Converts remaining H_2O_2 (0.1N) with hydroquinone. One-tenth of the total hydroquinone is circulated through

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Type GRF Conduulet with Lamp Receptacle


Type GSC Conduulet with Bracket Lighting Fixture


Type MB Two-Gang Watertight Marine Pilot Light Conduulet


Type V Vaportight Lighting Conduulet *for mounting on machines*


Type EFS Explosion Proof Conduulet with Double Pilot Light


Type GS Conduulet with Shock-Absorbing Lamp Receptacle *for use on machinery*


Type VDA Vaportight Observation Light Conduulet *for mounting on vats*


Type LMKB Lighting Conduulet


Type LMG Lighting Conduulet


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Type VXJ Vaportight Lighting Conduulet *for making extensions from concealed conduit wiring*


Type V Vaportight Heavy Duty Lighting Conduulet with Shatterproof Globe *for use in the food industry*


Type C Conduulet with Type ARC Vaportight Lighting Fixture


Type VXHA Vaportight Lighting Conduulet with Flush Hubs


Type VC Vaportight Lighting Fixture Conduulet


Type EVS Explosion Proof Portable Lamp


Type RMC Watertight Marine Lighting Fixture


Type MLC Watertight Marine Lighting Conduulet Shock Absorbing Receptacle


Type MLC Watertight Marine Lighting Conduulet


Type DLA Dust-Tight Lighting Fixture Conduulet with Flat Cone Reflector


Type LPH Safety Hand Lamp


Type EVG Explosion-Proof Lighting Conduulet *for gasoline pumps*


Type EVH Explosion Proof Hand Lamp


Type VS91 Vaportight Hand Lamp


Type RCD-8 Vaportight Lighting Fixture *for wall mounting*

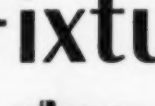

Type EVA Explosion Proof Lighting Fixture Conduulet


Type EVA Explosion-Proof Pilot Light Conduulet


Type RCDE-8 Explosion-Proof Pit Light


Type RCD-8 Vaportight Lighting Fixture *for floor mounting*


Type VLG Vaportight Gauge Lighting Conduulet *Fluorescent*


Type HNDS Conduulet with Lighted Sign


Type LG Gauge Lamp


Type VFC Vaportight Gauge Lighting Conduulet

Type VFC Vaportight Gauge Lighting Conduulet

Type ELG Explosion-Proof Gauge Lighting Conduulet

Type ELG Explosion-Proof Gauge Lighting Conduulet *Fluorescent*

Type VPH Vaportight Indirect Lighting Conduulet

Type VDB Vaportight Lighting Fixture Conduulet with Dome Reflector *500 Watt*

Type DLA Dust-Tight Lighting Fixture Conduulet *500 Watt*

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Complete listings of each type are in Conduulet Catalog No. 2500 or in supplementary bulletins.

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the precontactor. This is an excess, but free peroxide poisons the nickel catalyst. The precontactor was made of aluminum and contains 1 cu. m. of catalyst, a porous clay carrier containing metallic nickel and silver.

Reducer—The first reaction is carried out in this aluminum equipment at room temperature and 1-2 atm. pressure. A stoichiometric amount of H_2 is added for the product removed. Only one-half of the total quinone is reduced to hydroquinone in the reduction step. This is done purposefully because the combined presence of hydroquinone and quinone causes formations of quinhydrone which increases the solubility of the hydroquinone in the solution.

After Filter—A bag type filter is used, and cloths rarely need changing.

Cooler—A water cooler is used and, roughly, one-half of the heat of the over-all reaction is removed.

Oxidizer—Aluminum cannot be used wherever peroxide and hydroquinone solution are copresent because of corrosion. The oxidizer is of enameled iron and the heat pick-up is 7-8 deg. C. from roughly 30 to 37 deg. C. The entire mixing is done by dispersing the gas through a porous plate. Nitrogen is present and is recycled to eliminate loss of benzene vapor in the nitrogen effluent. Oxygen is added to the cycle. The oxidation is essentially complete and no hydroquinone is present in the exit. However, a slow hydrogenation of hydroquinone takes place in the reducer and tetra hydroquinone is formed. This is more difficultly oxidized, and therefore a new solution works somewhat better than an old solution.

Water Wash—Iron free water enters at the top of the reactor countercurrent to benzene solution. Twenty percent H_2O_2 solution is drawn off the bottom. The product can be stabilized and sold or further concentrated. The quinone solution is taken off the top. It contains 0.1-0.3 percent water and 0.01N H_2O_2. The water is removed by sending through 33 percent K_2CO_3 solution. This solution is maintained at strength by addition of 50 percent K_2CO_3 solution. The wash tower contains Raschig rings.

Aftercooler—Approximately one-half the total heat of reaction is taken off here.

Absorption Filters—These contain 1 cu. m. of activated alumina for removal of organic impurities.

Step 9—The product taken out the bottom of the wash tower contains 20 percent H_2O_2 at a pH of approximately 6.0 plus impurities consisting of benzene, some alcohols and traces of water soluble acids. This solution is stabilized with 20 mg. Na_2SnO_3 per liter and 30 mg. per l. NH_4NO_3 is added to inhibit aluminum corrosion.

Digest from "Hydrogen Peroxide Production Through 2-Ethyl Anthraquinone," OPB Report No. 395, by W. G. Gormley.

ALL-BASIC MARTIN FURNACES

IT WILL be of considerable interest to both steel-makers and the manufacturers of refractory bricks to know that the problems of constructing furnaces with super-structure entirely of basic material has apparently been solved in Germany during the war. The three Martin furnaces in Volklingen are constructed in this material and have apparently been giving very satisfactory operation. The bricks used included both magnesite and chrome-magnesite, and that in

Choose the Hooker Chlorinating Agent that Best Fits Your Process...

Whatever method or type of reaction you want to use to introduce chlorine into organic and inorganic compounds you can select the one best suited to your operations from Hooker Chlorinating Agents. Seven Hooker chemicals listed below are available for chlorinating. Their application is so widespread that we can only touch briefly here on a few of their uses in organic synthesis.

CHLORINE, Cl_2, readily enters into addition and substitution reactions with many types of organic compounds. With aromatic hydrocarbons chlorine is widely used for the chlorination of both side chains and nucleus of the compound by the use of the proper catalyst. Chlorine is also widely used in reactions with acetic acid, nitro compounds, sulfonic acids, esters and ethers. Hooker Liquid Chlorine made in the Hooker "S" cell conforms to the high standards of the industry.

HYDROGEN CHLORIDE, HCl, the anhydrous gas is used to form alkyl chlorides through reaction with alcohols, ethers and unsaturated hydrocarbons. It reacts with organic acid anhydrides to form acid chlorides. Hydrogen Chloride may combine with vinyl chloride, ethylene, and rubber to form many important compounds. Hooker Hydrogen Chloride is supplied in an aqueous solution as muriatic acid or it may be synthesized from hydrogen and chlorine under licensing arrangements with us.

SULFURYL CHLORIDE, SO_2Cl_2, is commonly used to form organic acid chlorides. It may be used to produce chlor derivatives of phenols and in the presence of certain catalysts to produce chlor derivatives of hydrocarbons or the sulfonyl chlorides of hydrocarbons.

THIONYL CHLORIDE, $SOCl_2$, available in a high degree of purity is a popular chlorinating agent because by-products of its reactions are sulfur dioxide and hydrogen chloride, gases readily removed by heating. It reacts with organic acids to form either acid chlorides or anhydrides depending upon ratio of acid to Thionyl Chloride.

SULFUR DICHLORIDE, SCl_2, is used as a chlorinating agent and in these reactions may be considered the equivalent of chlorine dissolved in sulfur monochloride. It reacts with sodium salts of organic acids to produce acid anhydrides.

SULFUR MONOCHLORIDE, S_2Cl_2, and SULFUR DICHLORIDE, SCl_2, are used in metallurgy to chloridize sulfide ores. They react with unsaturated hydrocarbons introducing sulfur or chlorine, or both in the molecule. Unsaturated fatty acids are treated with these chlorides to produce cutting oil bases. They also find extensive use in the manufacture of dye intermediates, rubber substitutes, military gases, insecticides, and pharmaceuticals. Phenolic resins can be made through the use of these chlorides. The sulfur chlorides which have a ready source of chlorine are ideal chlorinating agents with the added advantages of low cost, ease of handling and storage.

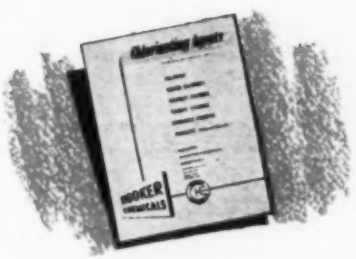
PHOSGENE (Carbonyl Chloride), $COCl_2$, is the acid chloride of carbonic acid. With alcohols it forms either chlorformates or carbonates. With amines it forms chloramides, substituted ureas or isocyanates. It enters into many Friedel-Crafts syntheses with aromatics to produce acid chlorides or aryl ketones. It may also act as an agent for direct chlorination. With metallic oxides and sulfides, it gives anhydrous chlorides. Reacting with organic acids it has been used to make acid chlorides and anhydrides.

HOOKER RESEARCH *Presents*

TETRAPHENYL TIN

$(C_6H_5)_4Sn$

This new Hooker Chemical is an almost odorless, white to light tan, crystalline, free flowing powder with excellent thermal stability. Melting point is 228°±1.5°C and Boiling point 424°C. Decomposition in glass at boiling point occurs very slowly. It is soluble in ethyl alcohol, insoluble in water. Among its suggested uses and applications are as an HCl scavenger for use with stabilizers in chlorinated compounds, as a preservative for mineral oils and as a reagent in chemical synthesis. Hooker Technical Date Sheet 733 containing additional physical and chemical data is available. Samples will also be furnished to those interested when requested on business letterhead.



BULLETIN No. 328A, a technical discussion on Hooker Chlorinating Agents, gives more information on these chlorinating agents and is available upon request. Our technical staff is also at your service in helping to solve problems involving the introduction of chlorine into organic chemicals or in the application of any of the many Hooker chemicals.

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spite of the heavy duty imposed upon the furnaces in the manufacture of high-class steels, the furnaces gave a life up to 1,400 charges between repairs.

This performance is far in excess of any recorded in this country, and having regard to the high temperature of the flame and stringent operating conditions, the practice at these works should be made the subject of investigation by a special team made up of representatives of both steel-makers and brick-makers.

Digest from "Rochling'sche Eisen und Stahlwerke G.m.b.H." OPB Report No. 847 by T. P. Colclough.

WHAT SHOULD BE DONE WITH GERMAN RESEARCH

GERMAN research and development on items for military application should be absolutely debarred. Laboratories now in existence which have served a war purpose primarily should be dismantled or adapted to peacetime projects. Likewise, all present German development projects whose application is chiefly to war, in whatever form, should be stopped and no new ones started. Severe penalties should be imposed for evasion or attempted evasion of these regulations.

Research directed toward normal and peacetime activities in pure and applied science should be allowed to expand to a level commensurate with German recovery. The following inspection system should be employed:

1. Registration and licensing of all research laboratories and the personnel therein; control of visas for travel abroad.

2. Disclosure of the budgets and other financial information of all German scientific research agencies, including government institutes and industrial laboratories. Also control of government funds appropriated for research and engineering.

3. Penalties for not making all new knowledge available to the Allied Control Commission and sending to this body copies of published material relating to scientific findings.

And since laboratory research results are ineffective and of very little value if the operations are not developed through the pilot plant or engineering stage, the Committee recommends the following rigid controls:

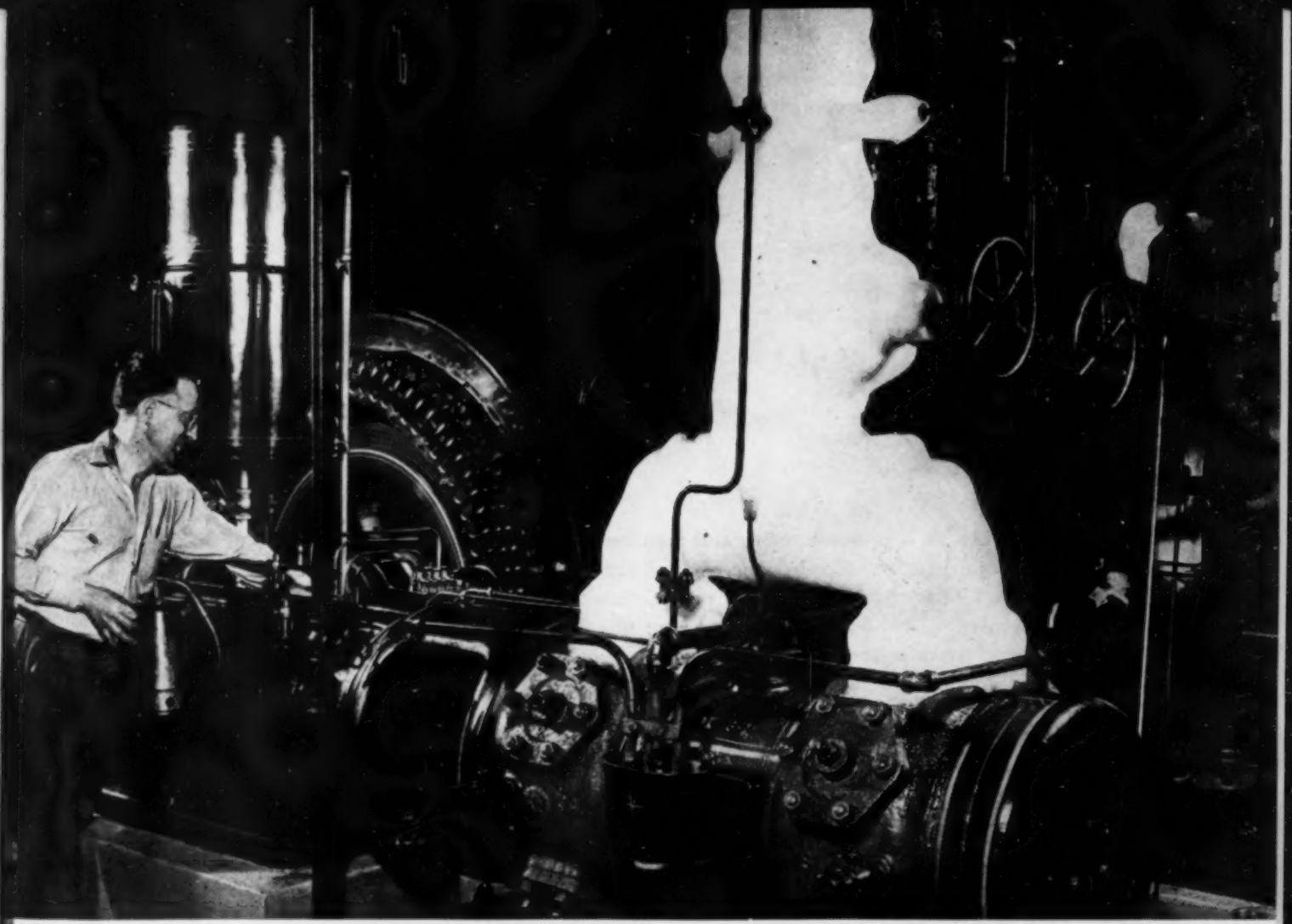
4. Permission for pilot plant construction or new engineering undertakings generally, including field trials of new devices and the testing of preproduction models, must be received from the Allied Control Commission.

5. Permission for production of any new items or of previously manufactured items by new processes must be received from the Allied Control Commission.

6. Control of production of those peacetime items which might also serve as supplies or munitions of war.

7. Official reporting to the Control Commission by scientists and technologists visiting Germany and non-governmental business from other countries of any suspicious activities.

A Technological Bureau included in the Commission of Occupation should undertake the execution of the above recommendations. This Bureau should have broad authority with regard to the supervision and control of German technological activities



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Eliminates Former Shutdown of 4 Compressors, Keeps Cooling System Operating

Trouble with sludge and carbon always forming in the compressors — that was the problem that confronted a large ice plant. Just when the plant was busiest it was necessary to shut down compressors for carbon removal and adjustments.

Then came the switch to Suniso Oils! Trouble from sludge and carbon stopped — not just temporarily — but for more than four years of operation.

Compressor valves haven't been replaced or refaced in that time. Operations now continue for ten months at a time without any mechanical interruption.

To keep your plant on stream, to keep production at a high rate and maintenance costs low, rely on Sun. Call the Sun man near you for engineering service, for refrigeration oils, lubricating oils, Diesel oils, compressor oils, processing aids, greases, micro-crystalline waxes, and other important products for modern chemical processing.

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and should be in charge of an outstanding scientist or engineer who has membership in the highest ranking Council of the Commission of Occupation.

The questions which arise in connection with the disposition of German scientists and of German scientific research are so important that the Committee urges the immediate appointment of an interallied scientific group to study and recommend the proper course of action. If this is not done at once, the process of dissipation now at work will soon carry the situation beyond the possibility of a wise solution.

Summary of conclusions from "The Treatment of German Scientific Research and Engineering from the Standpoint of International Security," TIDC Project 3.

PHLEGMATIZED P.E.T.N.

PHLEGMATIZING of P.E.T.N. was accomplished in the washing house. Two of the washers provided equipment for phlegmatization. In the original process phlegmatizing was carried out continuously by adding wax to the precipitator, however, with poor grade of labor encountered as time went on and the intricate and sensitive control necessary for such an operation, it was decided to make this part of the process a batch process and use extra washers as phlegmatizers.

The operation was conducted in batches of 500 kg. The kettles were used intermittently, one filling while one was empty. The kettles were jacketed and equipped with a straight blade stirrer operating at 140 r.p.m. The process was conducted by filling the kettle to the top of the stirrer blade with hot water at 70 deg. C., and then heating by direct steam injected to 95 deg. C. Then moist recrystallized P.E.T.N. in 500 kg. batches was added, a laboratory moisture determination being made on each batch to determine the necessary wax to add to produce a 5, 10 or 15 percent addition as desired for the particular grade necessary. Montan wax was used. It was charged into the melting kettle having a steam jacket. All pipes from the melting kettle to the filter and to the measuring tank were steam jacketed as was also the filter and measuring tank. The molten wax was colored a deep reddish pink by adding 0.5 percent of Sudan red B dye to the melter. This is to color the P.E.T.N. to distinguish it from other materials and to give a visual check on how well the job is being carried out. After adding the necessary amount of the wax to correspond to a dry weight basis of wax desired, the mixture was stirred for about 10 to 15 min., and the mass cooled to a temperature of 80 deg. C. Then the kettle was slowly emptied through a bottom barrel and a rubber discharge tube. At the same time cold water was squirted into the receiving nutch to cool down the mass of crystals to 35 deg. C. The water also served to eliminate any tendency for the coated crystals to stick or cluster. After a good suction, the moist crystals were transferred to bags and taken to the dry houses where the 500 kg. batch was treated as a unit and a control sample sent to the laboratory for physical, chemical and explosive quality tests.

Digest from "Manufacture of Phlegmatized P.E.T.N. at Fabrik Zur Verwertung Chemischer Enzungnisse G.m.b.H. Wolfratshausen," OPB Report No. 320 by A. A. Swanson.

CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

MODERN MATERIALS • MODERN METALS

Corrosion Testing in a Chemical Plant

S. W. SHEPARD
Chief Metallurgist
Calco Chemical Div. American Cyanamid Co.
Bound Brook, N. J.

Close-up of results of corrosion fatigue cracking in a hydraulic cylinder

IT WOULD be very nice and most convenient if a list of materials of construction could be compiled from which the most economical material for handling a given corrosive condition could be taken. Unfortunately, there are so many variables that influence corrosion rates that it is a hazardous procedure to make a selection from most of the lists of metals for handling the various acids, alkalis and recognized corrosives. It is almost as hazardous to select from previous plant usage—either your own or someone else's—unless you can be reasonably sure that all of the factors which govern corrosion are the same. We do not wish to belittle the value of such lists or previous plant experience. On the contrary we would like to encourage the publication of more information, and particularly, more complete information. At the same time it is well to emphasize the importance of conducting individual corrosion tests for each specific problem.

CORROSION TESTING

In order to get the specific corrosion information we need for designing new equipment or for improving old equipment we run corrosion tests in existing equipment, or under conditions as near plant conditions as possible. This information is kept on the Corrosion Test Piece Record. On this record we try to secure all the data that is pertinent to the test being run. Some of this corrosion testing is conducted in the research laboratories in their glass equipment. In general, when we are particularly interested in the effect of the metal on the quality and yield of the product, we use double the surface-volume ratio anticipated in the plant tool. We have had excellent correlation between the results obtained in laboratory flasks and in the metal pick-up in the plant. By working very closely with the research department, we have found that it is possible to cut down considerably on corrosion in selecting the agents used to minimize corrosion. It is much easier to make changes in a new process at this time than it is after the process has become more fully developed. Similar corrosion tests are carried through in the pilot or semi-plant operations, and finally in the producing plants themselves.

We do not know of any good substitute for getting our own information under our specific operating conditions. However there are some general principals that can be followed. There are factors that have an important influence on corrosion wherever they occur and they should always be considered whenever a selection is being made or a test conducted. The balance of this article will be occupied with an analysis of these factors; in considering them, their interdependence must not be lost sight of.

TEMPERATURE

In general, an increase in temperature increases corrosion rates in line with the ordinary limits of reaction velocity, say double to four times the rate for a rise of 50 deg. F. However, in some cases corrosion rate may be lowered by an increase in temperature through decreasing the solubility of gases in the liquid. For instance, the corrosion rate in water, acids, and the like may be much lower at 100 deg. C. than it is at 80 deg. C. because of the decreased solubility of oxygen in the liquid. Reduction of temperature to the point where the metal is below the dew-point of the air with which it is in contact will also lead to a tremendous increase in corrosion rate. This is especially important in the design of dryers handling materials that may contain volatile corrosives like HCl; at the place where the dew-point is reached corrosion will be severe.

At times a rise in temperature can increase corrosion rates much faster than the ordinary limits of reaction velocity would indicate. This may be due to the decomposition of films that were inhibiting corrosion at lower temperatures or because of local overheating or hot spots.

The temperature that is most important to consider, and which is most likely to be neglected, is the temperature of the metal at the surface in contact with the corroding medium. This may be illustrated by corrosion tests that were conducted for a direct fired muriatic retort. The temperature of the molten salt cake in the retort was 320

CORROSION TEST PIECE RECORD Sheet No._____

(When filled out return to Metallurgical Laboratory)

Chemist_____ Construction material_____
Engineer_____ Corroding product_____
Telephone_____ Sample No._____
I.O._____ Type_____
Division_____ Dimensions_____ X_____ X_____
Surface condition_____ Treatment_____

Weight issued_____
Weight returned_____
Weight loss_____ = MDD x Factor = IPY (Inches penetration per year. Uniform corrosion @ 365 days per year/24 hours/day.)
Concentration call attack_____.
Date installed_____ Date removed_____

CONDITIONS OF EXPOSURE

Product_____ Process_____ Operation_____ C.T.No._____
Corrosion sample: Hung in tool, completely immersed, percentage immersion_____%
Continuous immersion_____ Cycle if intermittent_____
Fastened to stirrer_____ Speed of stirrer_____ Distance from axis_____
Was there free access of corrosive media to whole surface___? If not, what percent___
Agitation produced by means of: Stirrer, scraper, air, steam, reaction, tumbling
Amount agitation: None____ Slight____ Considerable____ Violent____
Number of batches_____ Hours stirrer ran_____ Time of reaction_____ Hours
Total hours exposure_____ Type of equipment in which test was conducted_____
Temperature: Lowest_____ Average_____ Highest_____
Oxidising or reducing nature of corrosive media_____
Aeration: None____ Some____ Considerable____ Abrasion: None___ Some___ Considerable___
Effect on product: Discoloration_____ Yield_____
Volume of reactant mass in test_____ Volume of reactant mass in plant_____
Area of exposed surface of plant tool in square inches_____
Ratio of volume under test conditions to area of test piece_____
Ratio of volume under plant conditions to area of exposed tool surface_____

Chemicals: Acids_____ Concentration_____ Gases (Anhydrous or wet)
Alkalies_____ Concentration_____ Gases (Anhydrous or wet)
Salts_____ Concentration_____
Organic_____ Concentration_____ Vapors (Anhydrous or wet)

On back of sheet write history of other materials used and results obtained.

Recommendation:

deg. C. When this temperature was increased the corrosion rate of cast iron under test conditions was decreased slightly, probably due to loss of HCl, but when the molten salt cake temparature was held at 320 deg. C. and the temperature of the cast iron in contact with it was increased, the corrosion rate went up as shown in the table below.

Metal Wall Temp. Deg. C.	Molten Salt Cake Temp., Deg. C.	Corrosion Rate, Cast Iron, In./Yr.	Estimated Life of HCl Retort (Walls 2 in. Thick, 1.5 in. Lost)
320	320	0.0833	18yr.
350	320	0.2	7yr. 6mo.
400	320	1.0	1yr. 6mo.
450	320	3.7	4mo. 26days
500	320	11.5	1mo. 17days
550	320	27.0	18days

From this it may be seen that the life of a muriatic retort may be about 18 years if the temperature of the metal does not exceed the temperature of the molten salt cake, but may be only 18 days if this temperature differential is increased 230 deg. F. This situation is quite dramatic and it is easy to see that it is quite important not to have large temperature differentials on direct fired vessels if a low corrosion rate is desired. If the corrosion rate can be about doubled for a 20 deg. C. differential between the temperature shown in the mass of liquid being heated and the temperature of the metal through which the heat is being conducted at its point of contact with the corrosive, it is important to consider whether or not a high differential can be avoided. We may ask ourselves the following questions in regard to heating:

1. Is it necessary to use such high pressure steam?
2. Is it justifiable to decrease the life of the equipment in order to bring the temperature of the charge up rapidly?
3. Is the temperature distribution as uniform as economically feasible?

PRESSURE

Pressure has but a secondary influence on corrosion. It may increase corrosion by increasing the solubility of corrosive gases. Pressure differentials may influence corrosion by a cavitation effect. And pressure may have some bearing on fatigue failure, chafing, and some of the effects such as decarburization and hydrogen embrittlement that takes place in high pressure processes.

AERATION

The effect of dissolved oxygen may be of predominating importance, particularly in dilute solutions of the non-oxidizing acids. For instance, the corrosion rate of mild steel is about 0.03 in. penetration per yr. in 6-percent sulphuric acid at room temperature without air present and about 0.4 in. per yr. under the same conditions saturated with air.

In strongly oxidizing acids or with metals that depend on oxide coatings for corrosion protection, oxygen does not increase corrosion appreciably and in some cases decreases it. For instance, the corrosion rate of aluminum in 30-percent nitric acid is about 0.1 in. penetration per yr. without air and 0.08 in. per yr. with air.

When aeration is not uniform, corrosion

Stress corrosion cracks in a Type 347 stainless vessel. Cracking of this sort can be eliminated by using inhibitors and by reducing imposed stresses

tends to take place in the area where oxygen has the least access. This results in pitting and concentration cell attack. Although uniform corrosion rates might be low, if the pitting attack is rapid, such a metal is not as desirable as a metal with a higher uniform corrosion rate but is not susceptible to pitting attack under the existing conditions.

The presence of oxygen or other oxidizing agent may provide a passivating effect. This is particularly true with aluminum or stainless steel. It is more likely to occur with certain acids and oxidizing agents than others. For example, the corrosion rate of 18-8 stainless steel was 0.08 in. penetration per yr. (uniform corrosion in 3 percent sulphuric acid) without air, and 0.0002 in. per yr. with air.

For each installation we should answer these questions in regard to aeration:

1. Can the cover be made airtight?
2. How can the equipment be best protected between batches?
3. Can we use a protective neutral atmosphere economically?
4. Does air, dissolved or otherwise, have free access to the whole surface?
5. Are we injuring the equipment by using air to move the materials?
6. Does the stirring action draw air into the charge?
7. Would it pay to exhaust all air from the system?
8. In stainless or aluminum equipment operating under reducing conditions, are we providing sufficient air, oxidizers, or occasional passivation?
9. Can inhibitors be use that will counteract the effect of dissolved oxygen?
10. Can the liquid-vapor interface (wind and water line) be changed periodically?

AGITATION

Increase in the motion of the corroding solution accelerates corrosion by removing inhibiting films, by bringing more oxygen to the surface of the metal, and where concentrations are low, by bringing more corrosive to the surface of the metal. Turbulent flow

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increases corrosion markedly. Cavitation results in rapid failure.

During the first batch made in a new 1,000-gal. autoclave operating at 900 psi., the bottom of the draft tube was severely corroded as shown in the accompanying photograph. During the first batch the impeller was 21 in. in diameter and was running at 310 rpm. (peripheral velocity, 2,040 in. per min.). The result was that the draft tube was in some places completely eaten out in one run. By cutting down the diameter of the impeller to 19 in. and reducing the speed to 218 rpm. (1,300 in. per min.), corrosion of the end of the draft tube was

Draft tube of an autoclave that was severely corroded by excessive agitation

practically eliminated. There was no noticeable attack after three batches, other conditions being identical. The corrosion rate as measured in the draft tube during the first batch was approximately 12 in. penetration per yr. After having made 300 batches there was no noticeable corrosion on the draft tube, impeller, or sides of the autoclave.

Here are some questions to ask in connection with agitation:

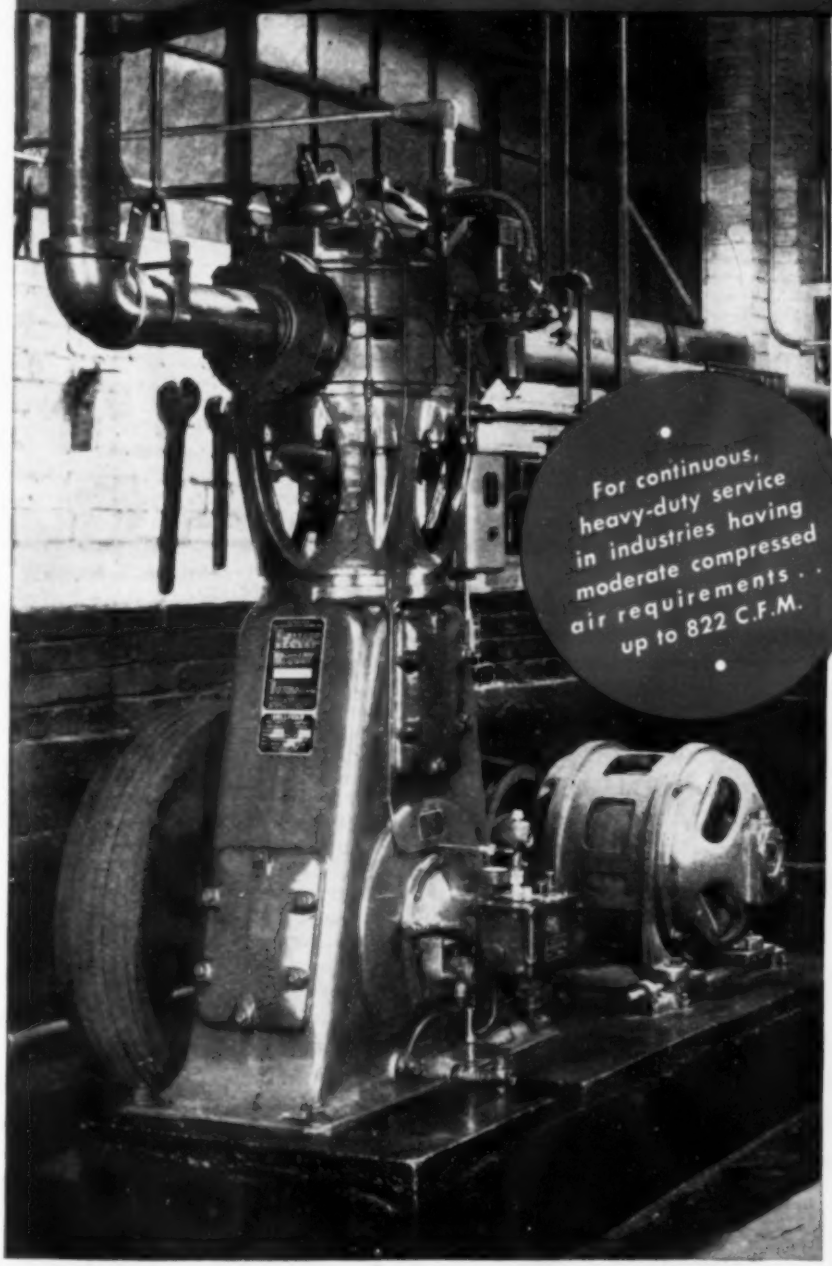
1. Are our stirrers, agitators, impellers, and other moving parts operating as slowly as advisable?
2. Is the agitator drawing air into the charge?
3. Could the pipelines be larger so that velocities could be reduced?
4. Can turbulence be eliminated?
5. Can cavitation be prevented by a change in pump characteristics, suction head, temperature, viscosity or speed of impeller?
6. Can a material more resistant to abrasion be utilized?
7. Can abrasive particles be eliminated?
8. Can removable wear plates be installed?
9. Would a stirrer of different design reduce corrosion rate?
10. Are baffles necessary?
11. Is agitation uniform?

GALVANIC PITTING

Dissimilar metals in contact is a common cause of localized attack. In general, the greater the distance between two metals in the galvanic series, the more rapidly corrosion of the less noble metal takes place. The galvanic or electrochemical series shows the tendency toward galvanic action. But actual electrolytic attack depends on several factors.

The circuit must be complete through

the WG-9 another Sullivan modern, heavy-duty compressor



• The Sullivan WG-9 air compressor is ideally suited for plants with moderate volume requirements or for specialized uses in large plants particularly where limited floor space is available. It is a double-acting, heavy-duty, single-stage compressor that will stay on the job twenty-four hours a day with the very minimum of maintenance.

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conducting metals and solution. Distilled water and any organic compounds are rather poor conductors and tend to suppress attack of this nature. Joints in the metal may be insulated by rubber, fiber, wood or other insulating materials to prevent galvanic attack.

Formation of hydrogen ions or a cathodic surface and insoluble protective films may slow or stop galvanic attack by polarization. Attack may be accelerated by removal of the hydrogen with oxygen, an oxidizer, and by formation of molecular hydrogen. In general, the larger the ratio of cathodic area to anodic area the faster the corrosion of the anodic area takes place.

Cathodic protection may be obtained by the sacrifice of some less noble material or through the use of an impressed current. As mentioned previously, concentration or solution cell attack may be developed by differential aeration through galvanic corrosion or by the same metal in different electrolytes. The amount of corrosion depends upon the supply of corroding agent to the cathodic area. Most of the corrosion occurs at the anodic area which thus becomes pitted.

Corrosion of the surface of the metal lowers its fatigue resistance. Fatigue stresses accelerate corrosive action. Corrosion simultaneous with fatigue stresses leads to rapid failure by corrosion fatigue cracks.

The following questions should be answered in regard to localized corrosion:

1. Is there a galvanic couple set up between two different metals, and, if so, could it be corrected by insulation or an imposed e.m.f.?
2. Are any rivets, bolts, thermometer wells, etc., that have fairly small surface areas anodic to the main vessel?
3. Is the corrosion subject to cathodic or anodic control by means of an inhibitor?
4. Could depolarization be prevented by elimination of oxygen or oxidizers?
5. Have irregularities in the surface or in the tool design been contributing to the concentration cell attack?
6. Have dirt or corrosion products been allowed to accumulate?
7. Do severe vibration, bending, or torsion stresses co-exist with corrosion?
8. Have sharp notches, threads, or fillets been eliminated as well as possible?
9. Have nickel or steel vessels used to handle alkalis been stress-relieved?

CORROSION INHIBITORS

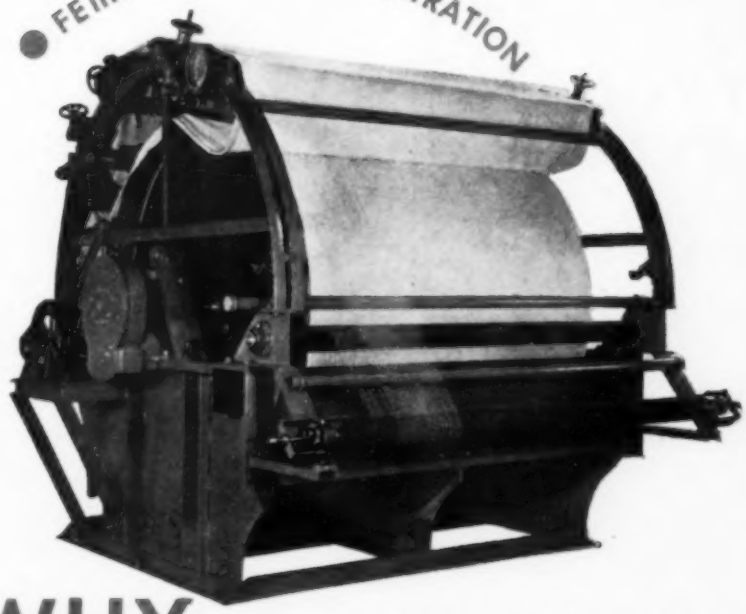
There are many organic and inorganic compounds that act as inhibitors of corrosion. Many of the organic materials encountered in the chemical industry do tend to inhibit corrosion. Of these compounds, the amines, the ketones, and some of the sulphur containing compounds such as mercaptans, are corrosion inhibitors.

Any organic base or positively charged colloid will act as an inhibitor of corrosion. However, it must be soluble or peptized in dilute acid.

A good many compounds or materials used in their manufacture are good corrosion inhibitors. Are we taking full advantage of them?

1. Are we sweeping them off with too vigorous stirring?
2. Are we heating the vessel walls above their effective temperatures?
3. Do we add them at the most effective time, or are we putting the acids in first

● FEinc CONTINUOUS FILTRATION



WHY THE FE STRING DISCHARGE IMPROVES FILTRATION AT LOWER COSTS

1 The dewatered cake is *lifted* from the revolving filter drum by strings on the FE Continuous Vacuum Filter. There are no scrapers to shorten the life of the filter cloth — no wire windings to impede filter cloth changes — no extra equipment for compressed air "blow back."

2 Since there is no severe mechanical strain or wear, lighter filter cloths can be used. These more nearly approach ideal filtering, permitting the cakes — rather than the cloth — to serve as the filter media. Cloths can be changed on an FE filter with far less "down time."

3 Filter cake leaves the FE filter drum in a continuous sheet of uniform thickness, as shown in the photos at right. Ideal where a uniform rate of feed is required for smooth flow of material to continuous drying or processing equipment.

4 Extremely thin filter cakes—as thin as 1/16 in. with some materials—and filter cakes from difficult slimes can be handled successfully on FE filters. Cake thicknesses as high as 12 in. and above can also be handled with some materials.

FE Continuous Vacuum Filters are available in plain designs for simple filtration work, and with any combination of the FE washing, dewatering, and cake-handling features for a wide variety of food, chemical, mining, sewage and other applications. Write for bulletins.

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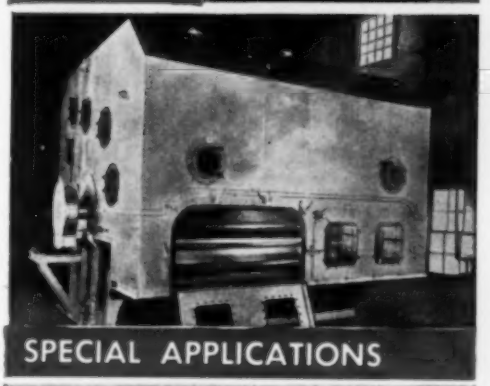


Typical Materials Successfully Handled

- Alumina Hydrate
- Cement
- Clay
- DDT
- Iron Oxide
- Lactic Acid
- Lithopone
- Magnesium Hydroxide
- Paper and Pulp
- Penicillin
- Phthallic Anhydride
- Sewage
- Silica Gel
- Soybean Protein
- Starch: Corn, Potato, Rice, Wheat
- Sugar Muds
- Sulfa Drugs
- Titanium Hydrate
- White Lead
- Zinc Stearate

and the organic inhibitors in after the harm has been done?

4. When corrosive mother liquors are to be recycled in a process that involves an organic inhibitor, could we add it to facilitate storage?

CORROSION NEWS BRIEFS

At the annual meeting of the American Coordinating Committee on Corrosion on February 26 in Pittsburgh the following officers were elected: chairman, S. Logan Kerr, S. Logan Kerr and Co., Inc., Philadelphia; vice-chairman, George W. Seagren, Mellon Institute of Industrial Research, Pittsburgh; secretary-treasurer, Hugh J. McDonald, Illinois Institute of Technology, Chicago.

E. I. du Pont de Nemours & Co. has announced "Teflon," a fluorine-containing plastic that the company has been making in pilot plant quantities since 1943. Teflon is made by polymerizing gaseous tetrafluoroethylene to yield a solid, granular polymer which can be extruded or compression molded. Its prominent characteristics are heat resistance, chemical resistance, and electrical properties.

As to chemical resistance, Du Pont says it withstands the attack of all materials except molten alkali metals; it can be boiled in aqua regia, hydrofluoric acid, or fuming nitric acid with no change in weight or properties; it resists the attack of organic materials and strong alkalis. Since Teflon can be used throughout the temperature range, —100 deg. F. to 480 deg. F., it should find immediate use as a gasket and packing material and as tubing for chemical process work. Samples of Teflon are available for evaluation.

National Association of Corrosion Engineers will hold its annual meeting and exposition in Kansas City, Mo., May 7-9. All meetings and the manufacturers' exhibition will be held in the Municipal Auditorium. The program is as follows:

Tuesday, May 7, 9 a.m.
Registration and opening of exhibits.

Tuesday, May 7, 2 p.m.
General assembly:
"Opening Address," R. A. Brannon, Humble Pipe Line Co., president NACE.
"Romantic Views of Corrosion," S. J. Rosch, Anaconda Wire and Cable Co.
"Economic Considerations of Corrosion Problems," F. A. Rohrman, Kansas State College.
General business meeting, 4 p.m., members only.

Tuesday, May 7, 7:30 p.m.
Buffet supper, President Hotel:
"Challenge of the Atomic Bomb," H. B. Hass, Purdue Univ.

Wednesday, May 8, 9 a.m.
Electrical and communication symposium:
"Cathodic Protection and Applications of Selenium Rectifiers," W. F. Bonner, Federal Telephone and Radio Corp.
"Corrosion In and Around Generating Stations," J. A. Keeth, Kansas City Power and Light Co.
"Attenuation of Drainage Effects on Long Uniform Structures," Robert Pope, Bell Telephone Laboratories.
"Corrosion Experience on Underground Lead Cables," J. M. Standring, American Telephone and Telegraph Co.
"Construction and Ratings of Copper Oxide Rectifiers," L. W. Burton, General Electric Co.
"Cathodic Protection Rectifiers," W. L. Roush and E. J. Wood, Westinghouse Electric Corp.
Water industry symposium:
"Cathodic Protection as a Corrosion Control Method Applied to Steel Surfaces Submerged in Water," L. P. Sudrabin, Electro Rust-Proofing Corp.
"Corrosion in the Water Industry," H. A. Price,

Los Angeles Dept. of Water and Power.
"Designing Water Pipe for Long Life and High Carrying Capacity," G. H. Garrett, Thompson Pipe and Steel Co.
"Corrosion in Cooling Water Systems and Service Lines," F. T. Redman, Hall Laboratories, Inc.
"Corrosion Problems as Applied to the Interior Water Distribution Systems," M. P. Hatcher and H. W. Poston, Kansas City Dept. of Water.

Wednesday, May 8, 2 p.m.

Gas industry symposium:
"The Installation and Protection of Underground Gas Distribution Systems with Pipeline Enamels," P. D. Mellon, Canadian Western Natural Gas, Light, Heat and Power Co., Ltd.
"Magnesium Anodes for the Cathodic Protection of Underground Structures," H. A. Robinson, Dow Chemical Co.
"Use of Fibrous Glass in Underground Pipe Protection," J. A. Grand and S. M. Peek, Owens-Corning Fiberglas Corp.
"Neutralizing Circuit for Elimination of Long Line Current Corrosion," W. R. Schneider, Pacific Gas and Electric Co.
"Results Obtained from Five Years of Cathodic Protection on 24-Inch Gas Line Rapidly Deteriorating from Bacterial Corrosion," W. E. Huddleston, Cities Service Gas Co.
Chemical industry symposium:
"Clad Steel Processing Equipment for Chemical and Allied Industries," E. C. Gosnell, Lukens Steel Co.
"Corrosion by Aqueous Solutions in Absence of Oxygen," N. E. Berry, Servel Corp.
"Condenser Tubes of Aluminum Alloys," R. B. Mears, Aluminum Company of America.
"Permeability and Corrosion in Protective Coatings," D. F. Siddall, United States Stoneware Co.
"Application of Carbon and Graphite to Resist Corrosion," C. E. Ford, National Carbon Co.

Wednesday, May 8, 7 p.m.

Banquet, President Hotel:
Speaker, H. Roe Bartle, Scout Executive Council, Boy Scouts of America.

Thursday, May 9, 9 a.m.

General industry symposium:
"Effect of Paint on Galvanic Corrosion," G. W. Seagren, Mellon Institute of Industrial Research.
"Disadvantages of Dissimilar Metals in Equipment," T. G. Hieronymus, Kansas City Power and Light Co.
"Maintenance of Oil Field Equipment," D. R. Hiskey, Dearborn Chemical Co.
"Corrosion Ratings for Metals and Alloys," H. D. Holler, Westinghouse Electric Corp.
"Designing to Prevent Corrosion," R. H. Brown and R. B. Mears, Aluminum Co. of America.
Oil industry symposium:
"Resistance of Some Nickel-Containing Alloys to Corrosion by West Texas Crudes," B. B. Morton, International Nickel Co.
"Down the Hole Treatment of Condensate Wells," T. S. Bacon, Lone Star Producing Co.
"Laboratory Studies for Determination of Organic Acids as Related to Internal Corrosion of High Pressure Condensate Wells," H. T. Griffin and E. C. Greco, Union Producing Co.
"Metallurgical Phases of High Pressure Corrosion Problems," M. E. Holmberg, Phillips Petroleum Co.
"Use of Sodium Chromate for Control of Corrosion in Gas Condensate Wells," C. K. Eilerts, H. A. Carlson, R. V. Smith, F. G. Archer, V. L. Barr, Bureau of Mines.
"Results of Some Studies of the Condensate Well Problem," W. F. Rogers and Harry Waldrip, Gulf Oil Corp.
"Down the Hole Treatments of Condensate Wells," Paul Menaul, Stanolind Oil and Gas Co.
"Prevention of Condensate Well Corrosion by Chemical Treatment in the Erath Field," W. D. Yale, Texas Co.

Thursday, May 9, 2 p.m.

Corrosion activities of technical societies:
"American Coordinating Committee on Corrosion," G. H. Young.
"American Foundrymen's Association," J. T. Mackenzie.
"American Society of Mechanical Engineers," S. Logan Kerr.
"American Society of Refrigerating Engineers," R. S. Taylor.
"The Electrochemical Society," R. B. Mears.
"American Institute of Chemical Engineers," R. B. Mears.
"Society of Automotive Engineers," E. H. Dix.
"American Society for Testing Materials," C. S. Cole.
"National District Heating Association," R. M. McQuitty.
"Technical Association of the Pulp and Paper Industry," J. A. Lee.
"American Petroleum Institute, Production Division," H. H. Anderson.
"American Water Works Association," H. L. Nelson.
"American Chemical Society," F. N. Speller.
"National Research Council," F. N. Speller.

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

PROPAGANDA without special knowledge may lead to embarrassment. Our new steam plant in '32 had been designed for burning high-volatile gas-coal screenings which contained more B.t.u. per dollar than any other fuel on our market. Incidentally, equipment was also provided for burning oil. A fuel oil salesman, representing one of the mammoth refineries, dropped in to urge the replacement of our 400-ton daily coal consumption with oil. Oil, he argued, offered greater economy and he admitted no qualifying conditions. Just before the salesman's arrival, the current issue of *Power* was delivered to the chronicler's desk and one of the feature articles described a great new steam plant at the New Jersey oil refinery of his company. This plant was designed by the oil company's engineers, well-known for their experience and good judgment. It was equipped with stokers and was burning coal!

TOM STEARNS, Columbia '81, one of the founders of Stearns-Roger Mfg. Co. of Denver, occasionally hobnobs with his friend "Murray" on the Columbia campus in New York. Although he is 21 years past the conventional 65-yr. limit, he reports to his office regularly. He says that when a man stops peddling he falls like a bicycle.

LABORERS from the tropical sugar fields of Jamaica were imported in the spring of '45 to take the place of sugar refinery workers of superior mechanical ability who had assumed the white man's burden in the shipyards at superior pay. About 120 "head" were assigned to our plant under government agreement that we house and subsist them. The steward at the rooming house dispatched them to work at 7 A.M. supplied with a generous lunch of super sandwiches. Most of the lunch was consumed enroute to the works and by noon these ravenous men of the jungle preempted the cafeteria. Each started modestly with a quart of milk and ended with three sectors of assorted pie pyramided sandwich fashion in order to gain the delight of three flavors at one bite.

The boys considered their 90-day American contract as a grand holiday at full pay. They could not submit to discipline. They had been represented as experienced raw sugar mill operators. When the foreman could find them and had time enough to stand by, they dropped dischargers into two of the centrifugals at top speed. By the grace of providence, the trajectory of the flying parts followed an open path but the day's profit for the plant was shot. One of the boys assigned to the dock made so bold as to caress a fellow worker of Aunt Jemima pattern. She bit a chunk out of his breast that sent him to the hospital. We paid the full American wage less the taxes. The Jamaican government took 25 percent of their pay to save for return to them when need arises later. The earnings were small as the men seldom appeared on the job more than three days a week.

CHEMIST BACHLER, researcher in Oxnard, Calif., in '02 was the first to suggest the application of the zeolite (ion exchange) water softening device to the purification of sugar juice. One pound of salt restrains four pounds of sugar from crystallizing. Bachler came to the land of milk and honey from Austria. In 1914 he took a busman's holiday in Cuba. By the time he boarded the steamer for return to America, the war had struck and the presence of the British secret service men on the deck reminded him that he was an enemy alien, having allowed procrastination and a heavy schedule of work to delay the acquisition of his final American citizenship papers. When chemistry won't, hokus pokus will! So Bachler reported illness and went to bed. The inspector respected the pale face and the closed eyes and passed him by. He had an American name anyway!

SUGAR MARKETING in paper bags did not originate in Savannah but it was resurrected there. In 1865 John Arbuckle, in his effort to overcome the wastefulness of marketing coffee in its green state, started the development of equipment by which the beans were roasted while suspended in superheated air. This imparted a superior flavor, and to retain this flavor he packed the beans while warm in tight paper bags. His competitors called them "little bags of peanuts." However the packages and the aroma pleased the housewives and the Arbuckle business grew. When Pioneer John Arbuckle filled coffee bags by hand and sold them to the housewives he was the forerunner in the creation of the demand for packaged food products. The semi-automatic packaging machine developed by his mechanical wizard, Smyser, was the granddaddy of automatic packaging equipment. It stimulated the growth of the traffic in coffee and, eventually, sugar into the great Arbuckle establishment. The Arbuckle coffee business grew so large that the export duty levied by Brazil furnished an occasional battleship for the South American country. The exchange of "Arbuckle" package signatures for premiums expedited the erection of the monumental Brooklyn postoffice. The premium department is said to have furnished more wedding rings than any other institution.

The success of coffee packaging suggested marketing sugar in two and five pound paper bags. Arbuckle's purchase of sugar in bulk for re-sale in packages grew so large that the refinery that supplied it sought to share in the traffic and attempted to negotiate for the purchase of Arbuckle packers. When this was declined, the refinery cut off Arbuckle's supply of sugar. To retaliate, Arbuckle built his refinery in Brooklyn which got into production in 1898. The old packaging machines, without improvements since 1925 but under the maintenance of Smyser's desciple, Frank Cocks, were suffered to remain for sentimental reasons, in spite of their obsolescence, till the Arbuckle refinery was dissolved in 1941.

INTELLIGENCE as to the customer's business serves a salesman in good stead and avoids loss of time. A cub power salesman, by way of acquiring experience, was sent into our field to propagandize the value of large electric display signs. His purpose was of course to increase the demand for his company's product. His subject was of no interest to us but he was admitted out of respect due to his House. He had committed his rote to memory and it was a long one. There was not a pause long enough to permit edging in an interruption. Finally, when he had reached the end of his great effort and paused to observe the effect, we told him that our power plant was generating byproduct power cheaper than his own!

PREJUDICE does not determine the most advantageous material to use for containers of various products under varying conditions. However in the case of refined sugar at the Savannah Refinery, Benny Oxnard (now V.P. of Great Western Sugar Co.) sensed the superior quality of paper over woven fabrics. He argued that paper had the advantage of freedom from lint and the sugar can be completely reclaimed without dust. The up-standing quality of paper favored an automatic machine not available to flabby woven fabrics. Besides, its use promised to permit a reduction of one twentieth of a cent per pound of sugar. President Ben Sprague suddenly announced that his company was prepared to deliver all of the standard packages, from two pounds up, in paper. His refinery is located off the beaten path and therefore less subject to visitation by the "sugar tramps." Accordingly his installation developed quietly under the handiwork of Benny Oxnard without benefit of the usual kibitzing by the gang.

Anyhow in 1936 when Ben Sprague sprung the announcement on the trade there followed a stampede for paper bags and equipment. The customer is highly sensitive to price and the nickle reduction per hundredweight that Ben named swung the business. Ben's arguments as to the sanitary advantages were interesting but a few families of microbes, more or less, had a lesser

influence with the great American housewife than the price. The southern consumers had hitherto favored cotton planters but now veered to arboriculturalists who extracted their livelihood out of the quick-growing trees of the tropical swamps.

On the other hand for the special purpose of parachutting sugar behind the lines of the African expedition we filled a War Department order for 260,000 hundred-pound packages using double cotton bags. The famous wood-stave sugar barrel passed out with 1945. It lost caste economically, politically and sanitarily along with the cracker barrel and the red hot, pot-bellied stove. Its prerogative as a prop to political decisions has been transferred to more modern devices on the banks of the picturesque Patomac.

ROLLINS had two interests, boiling sugar and playing poker, and although he was master at both, poker was the more engaging. His favorite avocation left little time for sleep. As he whiled away the night shift in the old "bar-room chair" in front of the Rocky Ford pans, he clutched a large bolt in his hand. When he nodded, the bolt dropped to the floor and brought him to consciousness.

A MACHINIST ("war baby") in the great Enterprise Diesel Engine Works of San Francisco quit flat right after the Japs had thrown in the towel. His enthusiasm for the aristocrat of jobs faded with the ending of the draft. He explained that he had nothing further to learn and was accordingly reconverting to his old job behind the wheel of a truck.

WHEN THE FIRST WAR flared up, luxuries had to be put aside. However, the LeConte Memorial Society requested us to complete a museum to commemorate the haunts of the famous geologist who had spent many years in exploration in Yosemite. We interned on this job one Wilhelm Harm, an ex-Prussian soldier who was a skillful stone mason. With two helpers, an air-drilling outfit and a generous quantity of dynamite, he proceeded to mine the granite, rough hew it and lay it into the walls. He was to carry on with little supervision from headquarters but was to apply his skill with vigor and faithfulness and otherwise to keep his mouth shut. He did a creditable job. Wilhelm had a picture of himself as an infantryman in the "Wacht Am Rhein" which exemplified the efficiency of the Prussian military system. The picture consisted of a photograph of his helmeted head mounted on a print of a glorified soldier. The part that differentiated one soldier from another was custom made but the rest submitted to mass production.

THE SINEWS of a reinforced concrete bridge are steel bars hidden within, and when the drawings are gone and the oldest inhabitant has forgotten what bars were used, there is no way of ascertaining how much load the bridge can sustain. And so a nameplate on such a structure should be made of imperishable bronze etched with the data that the engineer needs. In lieu of the usual plate that disfigures many bridges with names of politicians who will be charitably forgotten in an election or two, we

once installed a bronze plate, 8x10 in. engraved by Shreve & Company, the famous jewelers of San Francisco. Into this bronze were etched the load diagram, the position and size of reinforcing bars and some general statistics. A nameplate should justify the space it occupies by providing permanent storage of essential information.

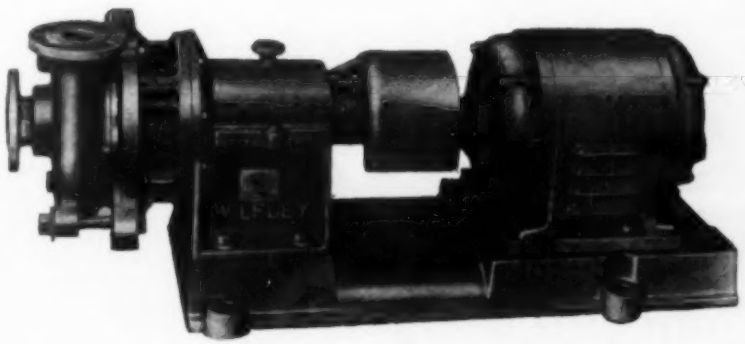
STEPHEN T. MATHER, who as an official of the Pacific Coast Borax Co., had devised the famous "20-mule-team" slogan, was director of National Park Service. During one of his visits to Yosemite, he ordered the preparation of plans for a luxurious Rangers' Club. Then he instructed us to build it and render the bills to him. He paid for it by personal checks and thus endeared himself to a faithful crew of public servants.

THE NAVY DEPARTMENT saw fit to give us contracts for four weather stations along the West Coast. The nearest to home was on Farallon Island. This island is a vertical jut of rock about 20 miles outside of the Golden Gate. There is no dock to which a ship can be moored. It was necessary to anchor the boat and deliver the materials by cableway. Sometimes the sea was so rough as to require the boat to return to San Francisco without discharging its cargo. We learned some fine points of law there.

The rock was manned by a detachment of U. S. Marines whose sole off-duty occupation was playing poker. During the long stormy evenings our crew joined in this activity and of course lost their money. The foreman carried an expense account from which he made withdrawals for petty cash expenditures and occasional advances against payroll. While he was sitting in with his crew and getting his trimming, one of the carpenters requested an advance and promptly lost it. At the month-end, when the carpenter went home, the wife berated him because he delivered no cash, and besides, he was in debt to the foreman's drawing account. She presented her complaint to a special court where employer-employee disagreements were adjusted. The judge ruled that the sums that the foreman advanced to the carpenter while they were occupied in a game of chance could not apply against wages! The judge's philosophy was not clear but his pronouncement from a practical point of view sounded reasonable. At any rate it maintained worker moral by insuring domestic tranquility.

OUR FIRST JOB at Mare Island Navy Yard (about 1910) was a four-story steel vault to house the valuable drawings of the hull department. After our details had been approved and delivered to the shop, a draftsman discovered that the government had specified the steel doors too small to admit the furniture! The appropriation for the contract was fixed. When the Public Works officer told us of the oversight, we relieved his mind by telling him that we could readily increase the size of the doors to fit the furniture. We hadn't done much work on them and so the cost of the change did not amount to much—but the officer did not know this! When the brickwork got underway, we requested the use of a Yard air hoist which was among the surplus

For ACIDS



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equipment that was available to contractors at a standard schedule of rental. A few days later the hoist was set up on the job and connected to the Yard compressed air system. There was a memorandum on the shop superintendent's desk instructing him to provide this service without levying the customary fee.

In front of the job there was a quarter-mile row of old Civil War cannons projecting out of the sea wall to serve as bollards for mooring ships. Two of these had become spattered with lime from our mortar pile, and so when clean-up time arrived, our painter covered these with a fresh coat of paint. When he observed the relative disparagement in the appearance of the rest, he painted the whole row. While the chronicler was watching the painter cover the last post, Admiral Tappan happened along on his daily inspection tour. He called and said "Gutleben, you boys seem to have the disposition to treat the government very squarely." A little later we were building an extension to the Mare Island Hospital. Excavation in those days was performed by mules and scrapers and the Vallejo Ferry daily transported our twelve teams across the straits at a dollar a team. The Admiral noticed this and asked why we did not use the empty government stable at the foot of Telegraph Hill and thereby avoid the daily ferry charge. We were thus continually swapping and there were never any arguments. Those Navy Yard engineers were mighty square men to cooperate with. We gave the government more than was due and at the same time the returns were up to expectations.

THE MARE ISLAND STATION was located on top of Telegraph Hill. To provide water for operators' quarters, we erected an elevated tank which was supplied from an automatic pump located at the foot of the hill. When the level in the tank dropped, a float started the pump which continued to deliver water until the tank was full. The main supply line from the bottom of the tank led to the cellar of the quarters building and from there, was distributed through the building.

One Saturday afternoon, before the job was completely finished, the marines moved in and stored in the cellar a large stock of supplies, including spinach, carrots, eggs, a week's rations of bread and bulk beans. When everything was moved in, the leathernecks were tired and went to bed—all but one! He climbed up the tank tower and opened the valve in the supply line which the plumber had closed because a 2½-in. elbow in the cellar had failed and he had not had time to get a new one. When the leatherneck got into his room, the water pressure was too low to provide for his bath and he retired in ill humor.

When the boys awoke on the morrow, they beheld two streaks of assorted green vegetables and beans extending all the way down the hill with a little streamlet of water in the middle. The flood from the tank had pushed next week's rations out through the trap door on the low side of the yard and in the absence of an impulse from the float control, the pump continued dutifully to perform until reveille brought the mess sergeant into action.

NAMES IN THE NEWS

W. W. Scull

E. R. Braun

F. Manchester

W. W. Scull, formerly plant manager of the Louisville, Ky., and Port Neches, Tex., government synthetic rubber plants operated by B. F. Goodrich Chemical Co., has been named production manager of plants for Goodrich.

W. F. Perkins is now manager of the tire testing laboratories of the B. F. Goodrich Co. Mr. Perkins, a graduate of Purdue University in chemical engineering, joined the company in 1928. For the last four years he had been manager of process inspection at the Lone Star Ordnance Corp. in Texas.

Oscar K. Irgens, for the past four years chief chemist at the Lake City, Missouri plant of the Remington Arms Co., has joined the chemical research staff of Gustavus J. Esselen, Inc., of Boston.

Lewis Larrick has been appointed acting director of applied research of the Institute of Textile Technology, Charlottesville, Va.

Gilbert L. Cox, metallurgical and chemical engineer, is in charge of the new Empire State Technical Section of the Development and Research Division, The International Nickel Co. Offices of the new section are located in the Genesee Valley Trust Bldg., Rochester, N. Y.

Louis A. Oberly has been appointed research director for the Hartford Rayon Corp. of Rocky Hill, Conn.

Walter Miller, who retired last month as vice president in charge of manufacturing for Continental Oil Co., has been retained by Universal Oil Products Co. as a consultant.

A. T. Nielsen, formerly application engineer with the Worthington Pump and Machinery Corp., has been named plant superintendent for the Citro Chemical Co. of America at Maywood, N. J. Mr. Nielsen received his master's degree in chemical engineering from Lehigh University.

Eric R. Braun has been appointed assistant director of engineering by Merck & Co., Rahway, N. J. Mr. Braun, a chemical engineering graduate of Princeton University, will also continue as chief chemical engineer, which duties he assumed last year.

Joseph M. Perrone, who for the last three years has been doing research and development work on protective coatings at Mellon Institute, has been named director of research of Watson-Standard Co.

O. E. May, chief of the Bureau of Agricultural and Industrial Chemistry, has resigned and has been succeeded by L. B. Howard, formerly assistant chief of the bureau. Dr. May left the Department of Agriculture to become associated with the Coca Cola Co. in an executive capacity.

Donald F. Chamberlain has been appointed assistant professor of chemical engineering at Washington University, St. Louis. Dr. Chamberlain assumed his duties on February 18. He was formerly employed in the research engineering department, National Aniline Division of the Allied Chemical and Dye Corp.

Allen M. Bond, Jr. has joined the Votator Division of The Girdler Corp. where he will have an important part in Votator's research projects and enlarged engineering service program. Formerly director of research of the Brown & Williamson Tobacco Corp., Mr. Bond served for three years in the Navy before joining Votator. He received his B. S. degree in chemical engineering at Purdue.

Boris Schwartz has been named chief research chemist for the Hart Products Corp., New York.

J. Eugene Lindsay has rejoined the research department of the Plastic Metals Division of The National Radiator Co., Johnstown, Pa., after more than four years of active duty with the Chemical Warfare Service.

Frank H. Manchester has been made plant manager of the Pathfinder Chemical Corp., vinyl plastics subsidiary of The Goodyear Tire & Rubber Co. He assumes active control of the Pathfinder concern, scheduled to go into production in August.

Ian M. Heilbron, professor of organic chemistry in the Imperial College of Science and Technology, University of London, received the Priestley Medal on April 8. The medal is awarded triennially by the American Chemical Society.

Robert B. MacMullin, formerly manager of development of the Mathieson Alkali Works, Inc., has announced the opening of a consulting practice in the field of chemical engineering, with temporary offices at 8249 Troy Avenue, Niagara Falls, N. Y.

M. Scott Moulton, of B. F. Goodrich Chemical Co., has been promoted to technical service manager for Geon thermoplastic materials. Mr. Moulton was formerly manager of coatings and film materials.

Arthur W. Lissauer, vice president of General American Transportation Corp., has retired.

Steuart E. Tray, chemical engineer, has been appointed assistant manager of the basic industries department in charge of the new chemical processing machinery section at the Allis-Chalmers Mfg. Co., Milwaukee.

Alexander Frieden, vice president and director of the technical division of Stein, Hall & Co., Inc., New York, has resigned. Dr. Frieden has been associated with Stein-Hall for more than ten years as technical director. The resignation is effective June 30.

John R. Van Wazer, formerly in charge of a physical chemistry laboratory in the Tennessee Eastman Corp. division of the Clinton Engineering Works at Oak Ridge, has been added to the research laboratory staff of Rumford Chemical Works, Rumford, R. I.,

as a physical chemist. **Robert H. Elliott,** M. D., an inorganic chemist for seven years at the Laurel Hill research laboratory of the General Chemical Co., will hold a similar position at Rumford.

Thomas J. Cain, Jr., has been appointed director of safety for all Akron plants of The B. F. Goodrich Co. He will head an expanded safety program as part of the industrial relations department.

William F. Newton has been appointed manager of market research and development for Columbia Chemical Division of Pittsburgh Plate Glass Co. Prior to his association with the Pittsburgh Plate Glass Co., he was employed by the Shell Chemical Co.

Homer S. Youngs, former chief of the chemical laboratory of the Santa Monica plant of the Douglas Aircraft Co., has been named director of the newly created Shippers' Research Division of the Air Transport Association of America. Primary duties of the new division will be to study and prepare regulations dealing with the safe transportation of hazardous commodities by air carriers.

Carl E. Barnes has been appointed head of the development laboratory of the Ansco film and camera division of General Aniline & Film Corp. Dr. Barnes has been a section leader at the central research laboratory in Easton, Pa.

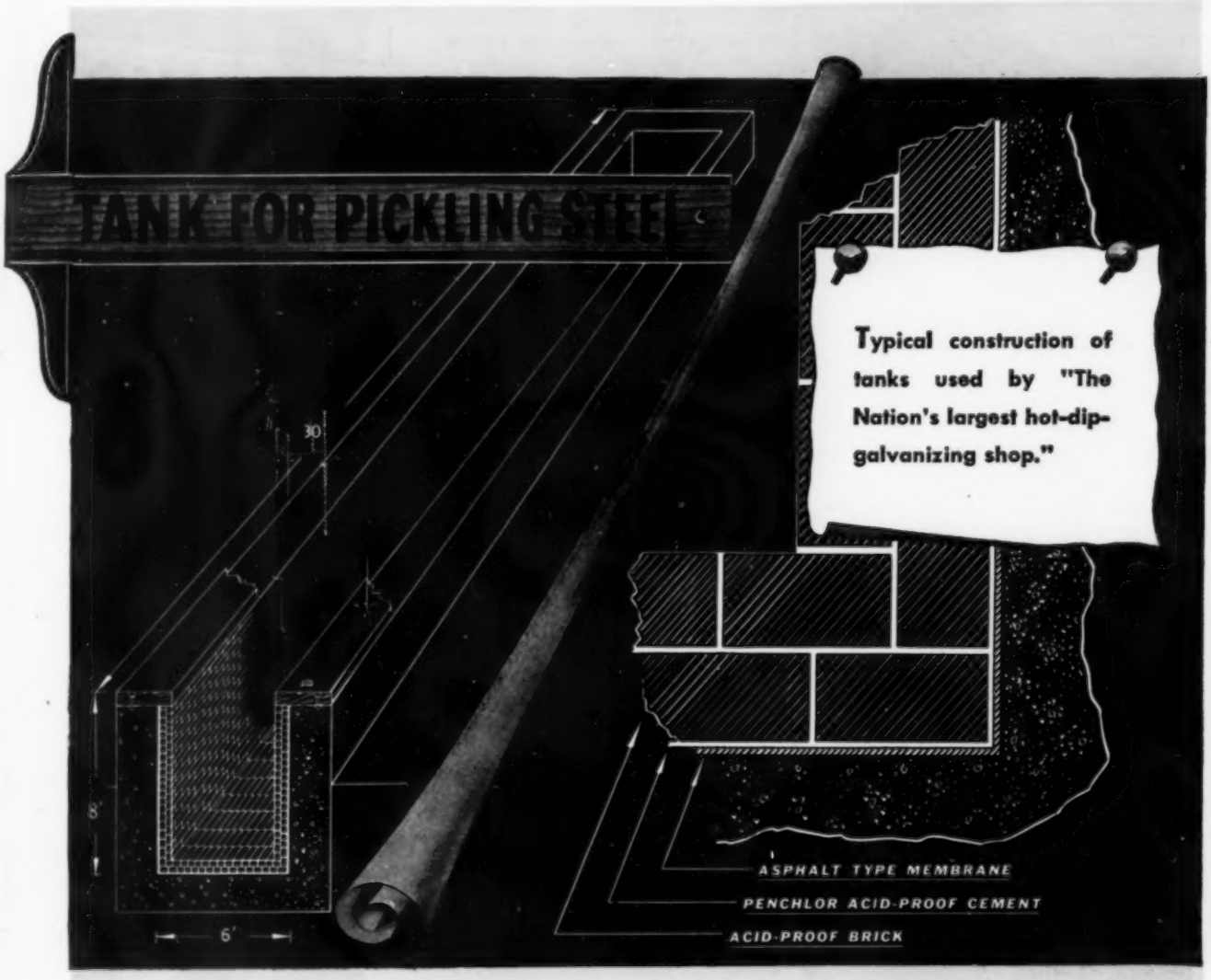
H. D. Kinsey has been appointed works manager for Carbide and Carbon Chemicals Corp., New York. Mr. Kinsey was formerly general superintendent of the atomic energy plant operated for the government by Carbide and Carbon Chemicals Corp. at Oak Ridge. The post of assistant works manager has been taken over by **R. K. Turner. T. R. Ragland,** who has been assistant superintendent succeeds Mr. Turner as superintendent.

William H. Aiken, former captain in the U. S. Quartermaster Corps, in charge of research and development work on coated fabrics and plastics, has been named assistant manager of the plastics and coatings department in the newly organized chemical products division of the Goodyear Tire & Rubber Co. Dr. Aiken is a chemical engineering graduate of Texas A. & M. College.

Eugene D. Milener has been apointed coordinator of general research of the American Gas Association. **Mahlon A. Combs** has been promoted from assistant secretary of the industrial and commercial gas section to secretary, succeeding Mr. Milener in this post. Mr. Milener's new duties consist of coordinating the general and technical utilization research of the association.

Arnold J. Lehman is now chief of the Division of Pharmacology of the Food and Drug Administration. Dr. Lehman fills the position left vacant last September by the death of **Herbert O. Calvery.**

Clifford R. Keizer, formerly associated with the central research laboratories at the Monsanto Chemical Co. has been named an instructor at Western Reserve University.



When steel plates are pickled, prior to galvanizing, in 10% sulphuric acid at 180° F., corrosive action is severe. The tank shown above is lined with a double course acid-brick, laid entirely with Penchlor Acid-Proof Cement, which gives corrosion protection and also withstands the physical abuse resulting from submerging and withdrawing steel plates in this solution.

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Cleveland. He was formerly an instructor of chemistry at the University of Illinois.

William M. Rand, president of Monsanto Chemical Co., has been elected a trustee of the Midwest Research Institute, Kansas City, Mo.

Charles D. Coryell has been appointed professor of chemistry at the Massachusetts Institute of Technology. He is chief of the research section on radiochemistry and fission products of the Clinton Laboratories at Oak Ridge. Dr. Coryell is now working on final reports for the project and will join the Institute in July.

Hugh A. Neal has rejoined Phillips Petroleum Co., Bartlesville, Okla., as assistant manager of the Perco division in the chemical products department. Lt. Col. Neal was with the parachute field artillery for more than five years.

Robert B. Jacobs has joined the staff of Distillation Products Inc., Rochester, N. Y., where he will direct the work of the physics laboratory which is concerned with the study of physical phenomena at low pressures.

S. A. Montgomery, manager of the Whiting, Ind., refinery of Standard Oil Co. (Ind.), has been made assistant general manager of manufacturing in the Chicago general office. He has been succeeded by **W. J. McGill,** manager of Standard's Wood River, Ill., refinery and **G. F. Ordeman,** assistant general superintendent at Whiting, has been promoted to succeed Dr. McGill.

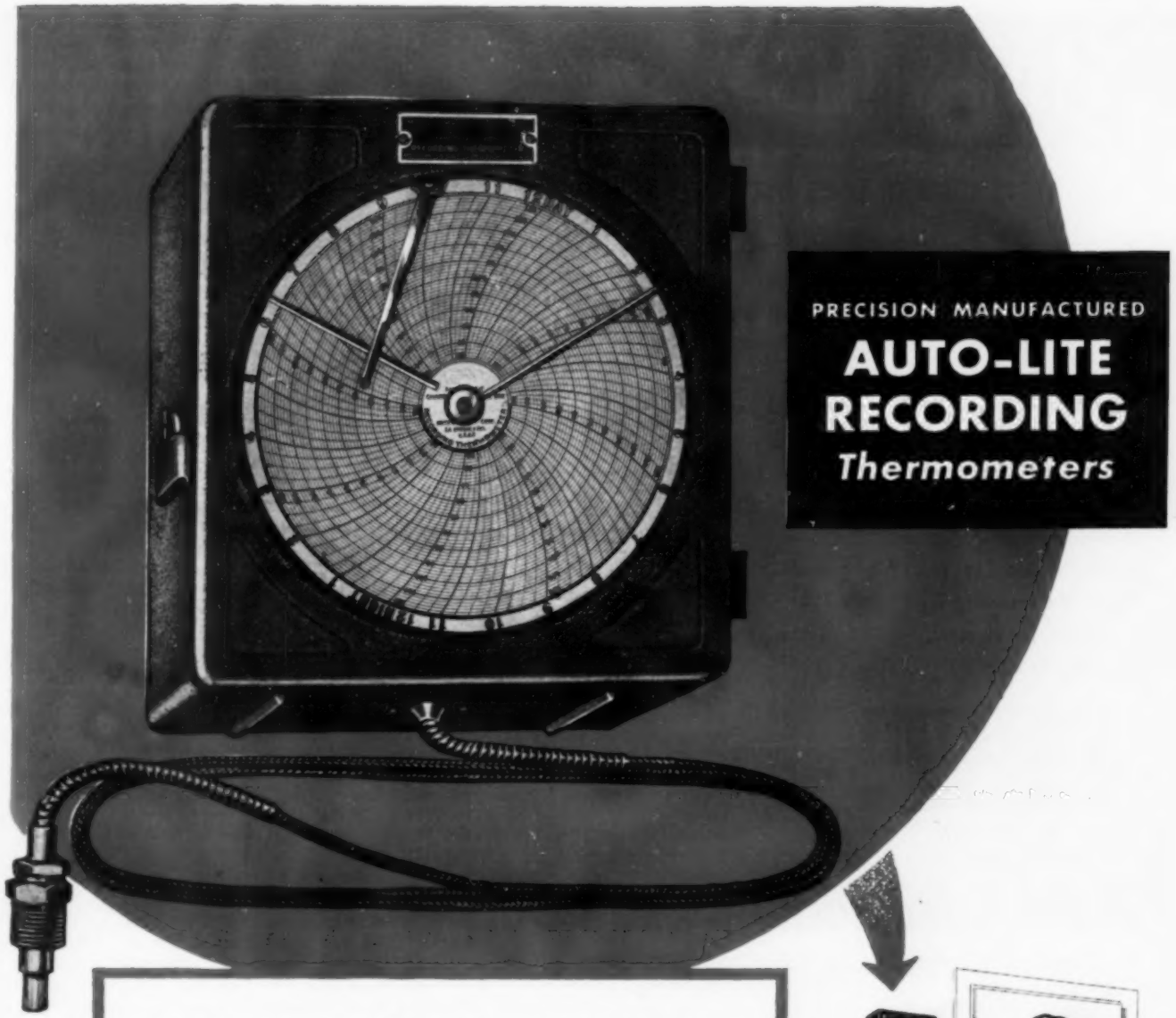
Frederick J. Clarke, a 30-year old engineer from West Point has been named commanding officer of Hanford Engineer Works, Richland, Wash., which produces plutonium as a source of atomic energy. Col. Clarke succeeds **Col. F. T. Mathias,** who has taken a civilian engineering job in South America. **D. A. Miller** succeeds **B. H. Mackey** as Du Pont plant manager of Hanford, while **T. M. Stepleton** becomes assistant superintendent.

Henry Sonneborn, III, until recently on active duty as a lieutenant in the USNR, and **Hans Schindler,** research chemist, have joined the technical staff of the Petrolia, Pa., refinery of L. Sonneborn Sons, Inc.

John J. Howe has joined Heyden Chemical Corp.'s Development Division.

Leonard M. Freeman has been appointed manager of the newly established works laboratories of The B. F. Goodrich Co. which will handle technical service, development and training of personnel. In the group are the general chemistry laboratory, raw materials inspection and development department and physical testing laboratories.

James S. Denham, assistant manager of the rayon department, E. I. du Pont de Nemours & Co., has been appointed general manager of the photo products department to succeed **George A. Scanlon** who has retired. **Robert L. Richards** has been promoted to fill the position left by Mr. Denham and **Robert A. Ramsdell** has been



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named manager of the nylon division succeeding Mr. Richards. **Charles M. Switzer,** nylon division director of production, has been advanced to the post of assistant manager of the division to succeed Mr. Ramsdell.

Harold L. Sheppard, assistant plant manager at the Newark, N. J., plant of the Celanese Corp. of America, has been named plant manager at Belvidere, N. J., the new plant recently acquired by Celanese for the production of plastics, chemicals and related products. **Charles C. Eckert** has been named production superintendent.

Frank C. Fowler has been appointed assistant professor of chemical engineering at the University of Oklahoma. For the past three years Dr. Fowler has been employed in the chemicals products department of the Phillips Petroleum Co.

Lee C. Cheney, a recent addition to the staff of Bristol Laboratories Inc., Syracuse, N. Y. has been assigned to synthetic organic research. Another newcomer at Bristol, **Alden B. Hatch,** is in charge of fermentation development. Other recent appointments include **Harry O. Nutting, Jr.,** chief construction engineer; **Robert C. Gasen,** special assistant to the general manager; and **William C. Risser** who will specialize in biochemical research.

R. C. Johnson has left Purdue University to accept an appointment as research engineer at Southern Research Institute, Birmingham, Al.

C. M. Croft has been named manager of the Celanese Mexicana, S. A., plant now under construction at Ocotlan, near Guadalajara, Mexico. Mr. Croft expects to take up his new duties sometime during the coming summer. Celanese Mexicana, S. A., is financed by Celanese Corp. of America and Mexican interests. The plant is expected to be completed in the near future.

O. M. Knudsen has been appointed to the teaching staff of the department of chemical engineering at Rose Polytechnic Institute, Terre Haute, Ind. Dr. Knudsen formerly taught at Michigan State College.

Philip Heiberger has joined the Arrow Lacquer Co., Brooklyn, N. Y., as chief chemist. He was formerly project leader with the Ralph L. Evans Associates.

Austin W. Fisher has joined the staff of Arthur D. Little, Inc., Cambridge, Mass., where he will supervise chemical engineering research. Dr. Fisher was formerly with the Barrett Division of Allied Chemical and Dye Corp. and with Publicker Industries, Inc.

Paul O. Powers, widely known for his work in synthetic chemistry, has been named to the staff of Battelle Memorial Institute, Columbus, Ohio, where he will coordinate and advise on an expanded program of research in organic chemistry.

Harvey N. Gilbert, director of sodium and cyanide products research at E. I. du Pont de Nemours & Co.'s electrochemicals de-

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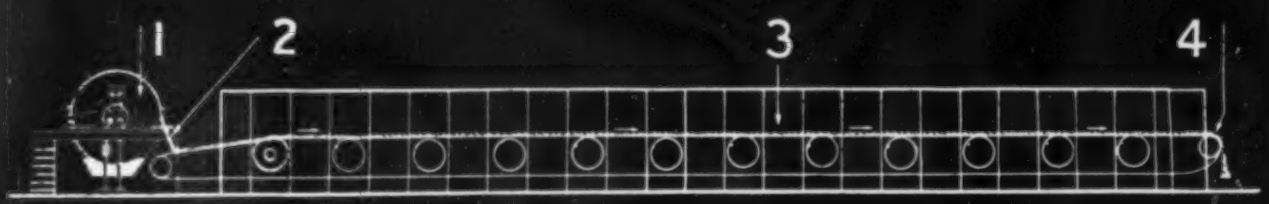
SPEEDS OUTPUT . . . IMPROVES QUALITY OF STARCH



1. Starch is mechanically dewatered by means of a rotary vacuum filter.
2. Having been scored on the filter, starch is delivered to conveyor of dryer in the form of ½" cubes, with a moisture content of 78.5% (B.D.W.B.).*
3. Due to the pre-forming of the starch on the filter and breaking the filter cake into ½" cubes, it is possible to dry starch rapidly—thus preventing case hardening and assuring thorough drying. Having been broken up into small pieces, it is possible for air to circulate through the bed of material on the conveyor. Temperatures average 180 F. at beginning of the cycle and 215 F. at the end.
4. Starch leaves dryer with a moisture content of 13.6% (B.D.W.B.). Capacity of dryer shown is about 4800 pounds (C.D.W.†) per hour.

*Bone Dry Weight Basis

†Commercial Dry Weight.

The physical characteristics of starch make it a difficult product to dry in large scale production. Dried too fast—or with temperatures that are too high—case hardening results and the dispersibility of the starch in liquid is ruined. Yet, with all of these factors to overcome, Proctor engineers have developed this continuous system that cuts drying time for starch down to a matter of minutes from 12 hours. Not only that, the system assures a starch that is free from surface baking or case hardening. Naturally, this greatly increases the output capacity over that which was possible with old-fashioned kiln drying. Dried starch is cleaner, contains far less impurities

Close-up shows ½" cubes of starch . . . the form in which it enters the dryer, after having been scored on the filter. Circulation of heated air through the bed of these cubes promotes rapid, uniform drying.

and has a better color than starch dried by less recent methods. Accurate control of final moisture content is assured, and this is an important factor. This Proctor continuous drying system for starch represents one more major contribution of Proctor engineers to more efficient production in the process industries. The entire system is the outgrowth of a problem that came to Proctor research laboratories a few years ago. If you have a drying problem, you'll be on the right track by consulting Proctor engineers now!

P&S **PROCTOR & SCHWARTZ · INC · Philadelphia 20 · Pa.**

partment, Niagara Falls, has been awarded the Jacob F. Schoellkopf Medal of the American Chemical Society's Western New York Section. The medal, awarded annually for outstanding service to chemistry, will be presented at a meeting on May 21.

Harold Ross, former chemist in the emulsion section of the research and development division of S. C. Johnson & Son, Inc., Racine, Wis., has been named production manager of S. C. Johnson & Son, Ltd., West Drayton, Middlesex, England. Other additions and changes in the research and development division include: **Edward Wilder** is now head of the natural and synthetic wax section; **Donald Whyte,** director of the new organic research section; **L. Keith Coad,** in charge of the physical research chemistry section; and **Enos H. McMullen** is now senior chemist in the natural and synthetic wax section.

Norman Ketzlach, formerly a chemical engineer engaged in research work, has been promoted to chief chemist in charge of both control and research laboratories for Manganese Products, Inc., Seattle, Wash. **Cyrus W. Richardson** formerly chemical engineer in research, has been promoted to superintendent of the new fertilizer plant now under construction. Both men are graduates in chemical engineering of the University of Washington.

Jacque E. Levy has recently become associated with the protective coatings section of Bureau of Ships, Navy Department. He was formerly attached to the Chemical Warfare Service and Ordnance Department, War Department.

Joseph C. Herbert, with the B. F. Goodrich Co. since 1927, has been named factory manager of the company's recently acquired tire plant in Tuscaloosa, Ala.

Lawrence W. Smith, M. D., is now associated with Commercial Solvents Corp., as medical director.

OBITUARIES

Alfred Springer, 92, dean of Cincinnati chemists, died in February after a long illness.

Donald B. Lowe, 62, medical director of The B. F. Goodrich Co. for 31 years, died March 2.

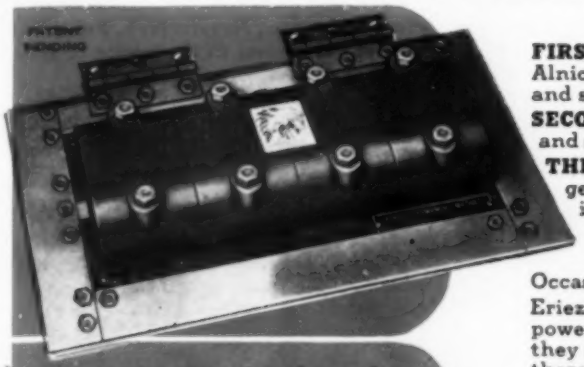
Albert L. Scott, 67, president of Lockwood Greene Engineers, Inc., died in his home at Chappaqua, N. Y., March 2.

George M. Deming, 53, chief research engineer for the Air Reduction Sales Co. in Jersey City, N. J., died March 18.

Gilbert N. Lewis, 70, noted scientist and dean of the College of Chemistry of the University of California, died in Berkeley March 23.

Edward H. Mayo, 77, credited with being the first man to make sulphate paper pulp from southern pine, died in Mobile, Ala.

WHAT IS ERIEZ PERMANENT MAGNETIC PROTECTION?



FIRST, it is the installation of powerful Eriez Non-Electric Permanent Alnico Magnets in all processing lines and on all machines where iron and steel trash could cause trouble.

SECOND, Eriez Magnetic Protection eliminates by the removal of iron and steel trash, the ever present fire hazard and costly machine damage.

THIRD, it is the least expensive kind of Permanent Protection you can get against iron and steel trash because it costs little initially—and it is *always on the job.*

FOURTH, it is no expense to you to operate. You install Eriez Magnets at points where they will do the most good and forget them. Occasional cleaning of debris is your only operation.

Eriez Magnets cannot spark. They are "ALWAYS ON" regardless of power or current conditions. Eriez cost less than ordinary magnets . . . they are lighter and easier to install . . . Eriez can be installed anywhere there is a 6 inch opening.

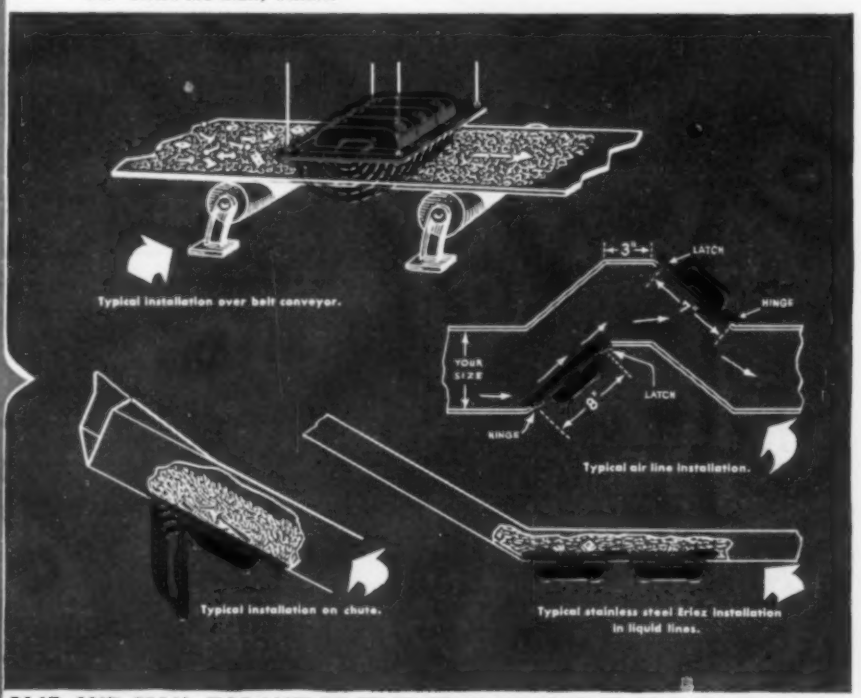
The following leading chemical processing plants using Eriez Non-Electric Permanent Magnets on conveying equipment, in chutes and feed tables and on processing machines prove their high value. *Why be satisfied with ordinary magnets . . . when you can get ERIEZ?*

PLASTICS AND CERAMICS: Ferro Enameling Corp., Lapin Products, Durez Plastics & Chemicals. CHEMICALS AND DRUGS: Dow Chemical Co., E. I. DuPont de Nemours, Stauffer Chemical Co., Monsanto Chemical Co., Tennessee-Eastman Corp. GLASS: Owens-Illinois Glass Co., Libby-Owens-Ford Glass Co. PULP AND PAPER: West Virginia Pulp and Paper Co., Fox Paper Co. GENERAL: Congoleum Nairn Inc., Johns-Manville, Proctor & Gamble, Raybestos-Manhattan, Makalot Corp., The Carborundum Co. There are many others.

ERIEZ Non-Electric Permanent Magnets Remove Iron and Steel Trash from:

ALUMINA
AMMONIA SODA
BROMINE
COKE BY-PRODUCTS
CASEIN CEMENT
CERAMICS
CHEMICAL COTTON
CYANAMIDE
ENAMEL (Porcelain)
FERTILIZERS FOODS GLASS
LIQUIDS MAGNESIUM
TERPENE CHEMICALS
OILS PAINTS
PHENOLIC PLASTICS-RESINS
PHOSPHATES POWDER
PULP SULPHATE
PULP SULPHITE
RAW SUGAR RUBBER
SALT SLUDGE
SOAP SOYBEAN OIL
SULPHUR

Sketch shows the construction of special Eriez Magnet, designed with center depressed insulation strip, or pocket for efficient removal of ball-bearings and microscopic particles of iron and steel from chemicals in process.



CLIP AND MAIL TODAY

Dear Sir: We are interested in removing tramp iron or ferrous particles from the following materials:

.....

We would like to know more about installation of ERIEZ on:
☐ Gravity Conveyors ☐ Mechanical Conveyors
☐ Pneumatic Conveyors ☐ Liquid Pipelines Magnetic Trap
☐ Equipment or Processing Machines

Name .....

Address .....

City ..... State .....

APR. 46

Eriez (Say EAR' EEZ)

ERIEZ MANUFACTURING COMPANY
1116 East 12th St. Erie, Penna.

INDUSTRIAL NOTES

Brown & Root, Inc., Houston, Tex., has expanded its industrial services through the creation of a petroleum and chemical division specializing in the design, engineering and construction of process plants.

Hercules Powder Co., Wilmington, Del., has reported that the paper makers chemical department sales office, Atlanta, Ga., has been under the management of J. Huston McClane since the early part of the year. Mr. McClane returned to civilian status after serving as a major with the Army overseas.

United States Rubber Co., New York, N. Y., has assigned Dr. Ernest J. Joss as administrative assistant to Ernest G. Brown, vice president and general manager of the mechanical goods, general products and "Lastex" yarn and rubber thread divisions.

Dow Chemical Co., Midland, Mich., has revealed that Lt. Col. Guy DeKuiper has returned to his work with the magnesium sales staff and will be stationed at Dow's Washington office. Robert L. Featherly has returned as a member of the magnesium sales staff on cathodic protection.

Rheem Research Products, Inc., Baltimore, Md., has announced the appointment of H. C. Irvin as manager of the eastern division of the company. Mr. Irvin's headquarters will be in Baltimore.

Pressurelube, Inc., Newark, N. J., has named William P. Turnesa to be director of sales.

Monsanto Chemical Co., St. Louis, Mo., has appointed Forrest M. Luckett branch manager of the organic chemicals division office in Cincinnati.

Sinclair Refining Co., New York, has appointed Paul W. Zumbrook as manager of domestic lubricating oil sales. In his new assignment, he will coordinate the service and distribution activity of the automotive and industrial lubrication staffs.

Corning Glass Works, Corning, N. Y., has named Russell Brittingham as assistant to the vice president in charge of bulb and tubing and technical products divisions.

Crocker-Wheeler Division, Joshua Hendy Iron Works, Ampere, N. J., has promoted I. C. Smith to the position of chief engineer.

Davis Engineering Corp., Elizabeth, N. J., has announced the appointment of C. Edward Bernard as manager of agency sales.

Godfrey L. Cabot, Inc., Boston, Mass., has added John Andrews to the technical sales staff of the company.

Standard Oil Co. (Indiana), Chicago, Ill., has moved W. H. Taylor to the position

of office manager at Milwaukee, Wis. O. C. Lunsford has been promoted to the position of office manager at Green Bay, Wis.

S. P. Kinney Engineers, Inc., Pittsburgh, Pa., has made J. B. Dannenbaum, Houston, Tex., agent for the company's water strainer equipment in the southern Texas district.

Bauer Bros. Co., Springfield, Ohio has elected Col. Joseph C. Shouvlin as its president. Prior to his recent return to civilian life the colonel was in command of the Cincinnati Ordnance District.

Westinghouse Electric Corp., Pittsburgh, Pa., has integrated the manufacturing and engineering facilities of the B. F. Sturtevant Co. with those of the Westinghouse air conditioning division which has been transferred from Jersey City to the Sturtevant main plant at Hyde Park, Boston. The new organization is known as the B. F. Sturtevant Co., division of Westinghouse Electric.

A. P. Green Fire Brick Co., Mexico, Mo., has named Lt. Comdr. Robert S. Green to the position of president. He will take over his duties on May 1. He will succeed his father, Allen P. Green, who moves up to the position of chairman of the board of directors.

Speedway Conveyors, Inc., Buffalo, N. Y., has named O'Roland Read director of sales.

Solvay Sales Corp., New York, has established a new office in Houston, Tex. This new office will cover the states of Texas, New Mexico and Arizona.

U. S. Industrial Chemicals, Inc., New York, has appointed Alden R. Ludlow, Jr. manager of alcohol and chemical sales.

York Corp., York, Pa. has formed an international division with headquarters at 50 Broadway, New York. James C. Tweedell is manager of the new division.

National Electric Products Corp., Pittsburgh, has appointed S. B. Knutson general superintendent of the Flexsteel Division at the Ambridge plant.

Roots-Connersville Blower Corp., Connersville, Ind., has elected J. S. Tatman chairman of the board and John Avery president and general manager.

Goodyear Tire & Rubber Co., Akron, Ohio, has selected J. H. Conrad and Robert Anderson to handle a study of pliofilm as a moisture-vapor-waterproof packaging material.

National Starch Products, Inc., New York, has opened a southern division with headquarters at Front St., New Orleans. H. F. Stegall is manager.

Maas & Waldstein Co., Newark, N. J., has made C. B. Knepper and C. R. Peterson sales representatives operating out of the Chicago office.

Rheem Research Products, Inc., Baltimore, Md., moved the manufacturing and sales

operations of the Eastern Division to 4004 East Monument St., Baltimore, on the first of April.

Electro Rust-Proofing Corp., Dayton, Ohio, has been acquired by Wallace & Tiernan Co. Inc., and Dorr Co. E. H. Ingle continues as president.

Stein, Hall & Co., Inc., New York, has opened its new Chicago offices and laboratories at 23 East Jackson Blvd. The new location includes general and private offices, an industrial and a food laboratory.

Chicago Metal Hose Corp., Maywood and Elgin, Ill., has purchased the entire capital stock of Apex Machine Co., Elgin, and will operate the new unit as a division of the parent organization. The engineering staff will function as a department of Metal Hose.

American Engineering Co., Philadelphia, has promoted F. C. Messaros to the position of chief engineer.

Harper Packing Co., Inc., Chester, Pa., has secured the services of James A. McPeak and Raymond P. Farrell in a managerial and financial capacity.

Dexter Chemical Corp., New York, has selected Alfred Driscoll as a member of the research staff of its textile chemical division.

Dow Chemical Co., Midland, Mich., has assigned Murray W. Healy and William F. Hardy, both recently released from the United States Army, to the St. Louis, Mo., office.

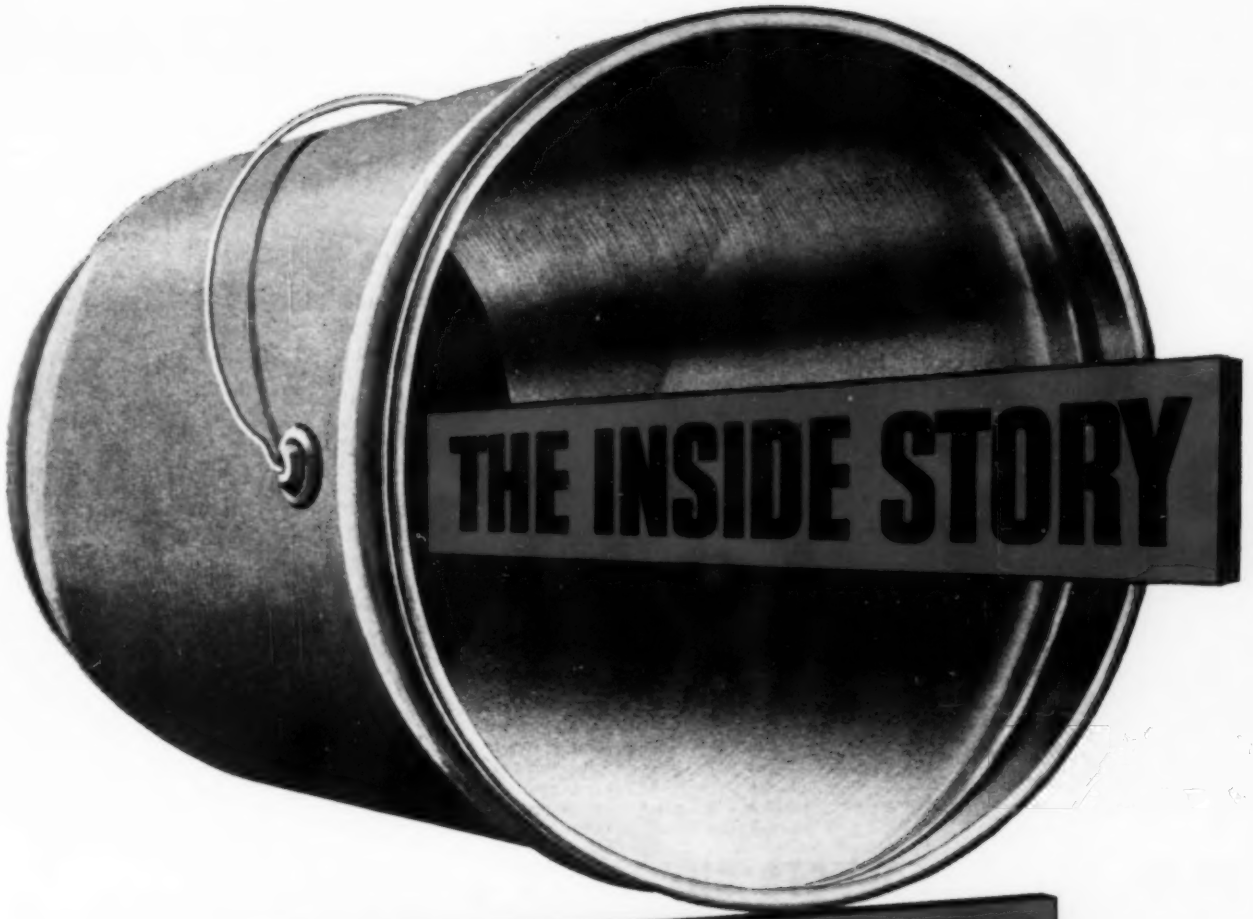
Joseph Turner & Co., Ridgefield, N. J., has returned Jack Henry, recently released from the Navy, to his position in the sales department.

Ampco Metal, Inc., Milwaukee, Wis., has placed F. C. Hawks on the sales staff as a field engineer, specializing in mill products. J. R. G. Harris becomes manager of resistance welding sales. D. S. Goebel has been appointed manager of mill products sales. G. E. McCulloch is now manager of safety tool sales.

Portland Gas & Coke Co., Portland, Ore., announces that C. H. Gueffroy has been elected a vice president of the firm to have charge of market investigations and sales of byproduct benzol, toluol, solvent naphtha, lampblack and creosote oil.

General Electric Co., San Francisco, has appointed Marion S. Barnes as assistant manager of the central station division of the apparatus department in that city. Mr. Barnes, a graduate of the University of California and an employee of the company for over thirty years, was formerly sales engineer and test man

Food Machinery Corp., San Jose, Calif., has announced the appointment of Howard C. Lisle as manager of the combined operations of the Bean-Cutler Div., San Jose, Calif., and the John Bean Div., at Lansing, Mich. T. O. Eaton, formerly with General Electric at Pittsfield, Mass., will succeed



OF WHEELING CONTAINER SERVICE

Special container linings are required by many individual products. So we start working on your packaging problem from the inside out. A wide selection of steel container sizes and types offers accommodation for almost any product. And we'll reproduce your present label or design a new one through our complete lithography facilities. Why not consult us on your present or future steel container needs and let us advise you on our ability to meet them.

WHEELING CORRUGATING COMPANY • WHEELING, W. VA.

Mr. Lisle as manager of the Lansing division. These administrative changes have been made to coordinate more closely the activities of the two divisions manufacturing similar lines of agricultural and fire fighting equipment.

Wellman Engineering Co., Cleveland, Ohio, has elected W. C. Swalley as vice president in charge of sales. A. J. Lichtinger has become a member of the board of directors.

Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., has promoted G. Webber Knight to the position of manager of the Washington, D. C. Office. R. George Hartig has been transferred to the Special Chemicals Division to aid in the plastic program.

Hammel-Dahl Co., Providence, R. I., has promoted Russell Milham to district sales engineer in charge of their Chicago and Mid-West District.

Northern Equipment Co., Erie, Pa., will be represented in Southern New Jersey, Southeastern Pennsylvania, Eastern Maryland and Delaware by the Kissick Co., Philadelphia. The company will act as sales and service representatives for Copes regulators, pump governors, desuperheaters and allied equipment.

Colorado Fuel and Iron Corp., Wickwire Spencer Steel Division, New York, has promoted Alvin F. Franz to the position of works manager of the Pueblo, Colo. plant. G. Gordon Lloyd has been promoted to general superintendent of the Buffalo plant. In his new position Mr. Lloyd will be in charge of all production at Buffalo, including open hearth, hot mills and wire departments.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. has named R. F. Muller assistant manager of the New Orleans district office.

Filter Media Corp., Irvington-on-Hudson, N. Y., has moved its factory and main office to Hamden 14, Conn., where it will have much larger quarters. Branch offices in Chicago and Salt Lake City are continued.

United States Rubber Co., New York, has promoted Walter F. Spoerl to be general sales manager of the mechanical goods division.

Catalytic Engineering and Construction Co., Philadelphia, Pa., is the name of the new company formed to engage in the design and construction of oil refineries and oil refinery equipment. T. Ellwood Webster is president of the new company.

Edward Valves, Inc., East Chicago, Ind., has advanced Raymond A. Durand to the position of sales manager.

Emulsol Corp., Chicago, Ill., has appointed Wilfred S. Cowan chief engineer of the company.

American Development & Engineering Corp., Boston, Mass., has been established to provide supervision of construction and operation of plants for the manufacture of

ORONITE
REG. U. S. CHEMICALS PAT. OFF.

THE NAME TO WATCH IN CHEMICALS

PURIFIED SULFONATE

—ONE OF FOUR BY ORONITE

PRIMARY APPLICATIONS	
USED IN:	PROPERTIES CONTRIBUTED BY PURIFIED SULFONATE:
Emulsifiers	Imparts polarity to oil phase
Soluble Cutting Oils	Emulsifying action
Textile and Leather Oils	Wetting and emulsifying agent
Emulsion Breakers	Ability to migrate between phases
Rust Preventives	Displaces electrolytes from metal surfaces
Fat Splitting	Improves contact between acid and fat

Purified Sulfonate, one of four different sulfonates made for particular industrial uses by Oronite, has polar properties as evidenced by its power to orient itself at oil interfaces, making it exceptionally efficient for the preparation of the specialized products listed above.

Laboratory samples are available if desired for your own experimentation. Please write for them, or for further information concerning specific applications, on your own business letterhead. No obligation will be involved.

TYPICAL TESTS:	
Content by Weight	
Sodium Sulfonates*	65%
Mineral Oil	29
Water	6
Inorganic Salts	None
Free Acidity	None
Free Alkalinity	Trace
Molecular Weight (Sodium Sulfonate)	440 (approx.)
Weight, lbs. per. gal.	8.6
Approximate pH Value	8.5

Clay absorption method

1178

ORONITE CHEMICAL COMPANY

Russ Building, San Francisco 4, California
White-Henry-Stewart Bldg., Seattle 1, Wash.

30 Rockefeller Plaza, New York 20, N. Y.
Standard Oil Bldg., Los Angeles 15, Calif.

rayon, as well as those suited to the production of purified cellulose and cellulose products. Gustavus J. Esselen heads the new organization.

Link-Belt Co., Chicago, Ill., has named Arthur J. Olson district sales manager at Kansas City, Mo.

Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J., has placed Harry E. Smith in complete charge of the corporation's rubber product sales and marketing.

Bemis Bro. Bag Co., St. Louis, Mo., has purchased the Indiana Cotton Mills at Cannelton, Ind. A new company was being organized to operate the plant. The transfer was made effective April 1, 1946, without interrupting the operation of the mill.

American Brake Shoe Co., New York, has appointed Roger W. Batchelder general purchasing agent. He recently returned from the armed forces, holding the rank of Colonel at the time of his discharge.

Polytechnic Research & Development Co., Inc., Brooklyn, N. Y., announces the opening of its consulting engineering laboratory coincident with a change in name from P. I. B. Products, Inc. The new name has been adopted to better identify the expanded operations of the organization.

Duriron Co., Inc., Dayton, Ohio, has made the following changes in personnel locations: R. C. Schenck has been made executive vice president. W. D. Staley is now in charge of the New York sales office. R. A. Prosser has taken charge of the Chicago sales office. W. A. Schumacher has taken over the Detroit sales office. R. H. Stalbaum now handles sales for the New England States.

Traylor Engineering & Mfg. Co., Allentown, Pa., reports the appointment of Lt. Col. Clyde W. Spears as special sales engineer.

Sugar Research Foundation, Inc., New York, reported the appointment of Neil Kelly as executive director, and the resignation of Ody H. Lamborn from that post. Mr. Lamborn was elected to the board of directors.

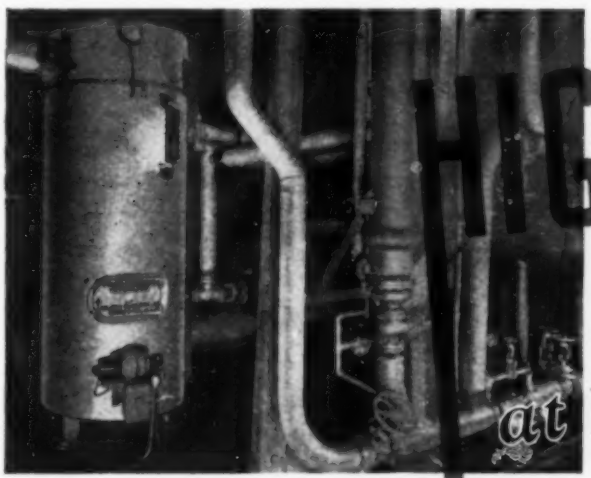
Sprout-Waldron & Co., Muncy, Pa., announces that its representation for the entire state of California will be in the hands of Ralph J. Musser, Los Angeles, Calif.

American Tool & Machine Co., Hyde Park, Boston, Mass., has named J. F. Tholl president. C. I. Day has become chairman of the board.

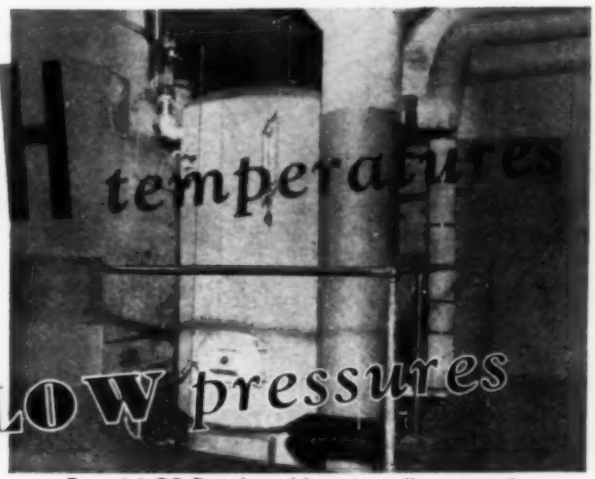
Manning Maxwell & Moore, Inc., New York, N. Y., has announced the appointment of J. Robert Kelly as executive vice president.

Sarco Co., Inc., New York, has opened an office at 1129 Vermont Ave., N. W., Washington, D. C. The office is in charge of Major H. F. Collins, formerly of U. S. Army Engineers.

Wide Range, Heat-Transfer Operations Employing McKEE ARTWORK **DOWTHERM VAPORIZERS**

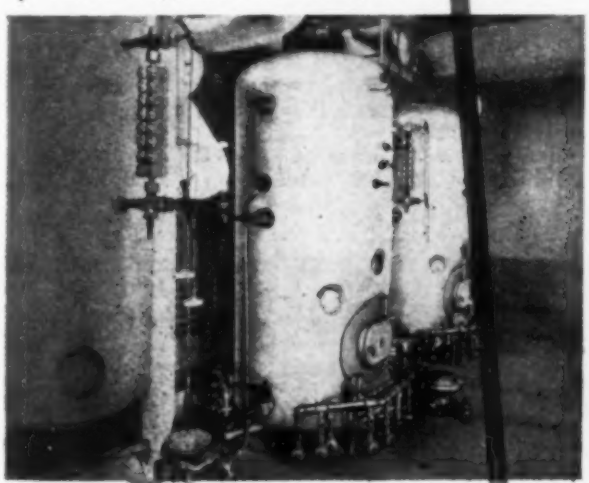


Dowtherm application in Oil Polymerization Process.

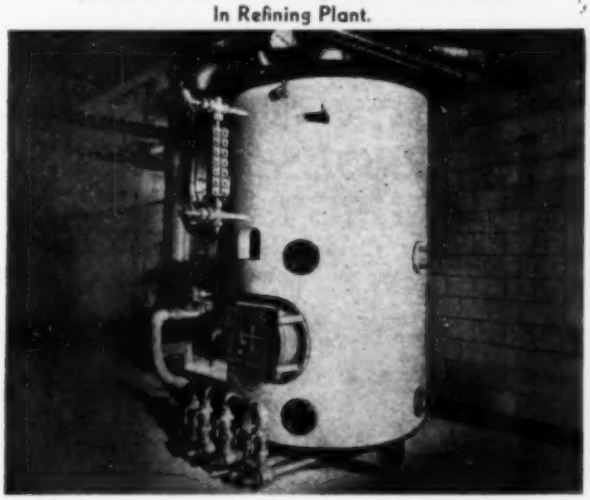


Type 3AOR Dowtherm Vaporizer off-on control. In Refining Plant.

HIGH temperatures at LOW pressures



Type 3-A McKee Dowtherm Vaporizers. In Varnish Plant.



McKee Dowtherm Vaporizer. In Food Processing Plant.

Above are a few of many heat-transfer operations requiring temperatures up to 700° F. in which McKee-Eclipse Dowtherm Vaporizers are used with the following distinct advantages —

With temperatures as high as 650° F. the pressure is less than 55 lbs. Requires lighter, less costly installation. Using vapor phase or liquid phase—there's no local overheating — no burning, scorching or discoloration of the product.

A *complete unit,* the McKee Dowtherm Vaporizer is fully assembled — ready for installation. Write for bulletin giving complete details. Eclipse Fuel Engineering Co., 719 South Main St., Rockford, Ill.

McKee-Eclipse Dowtherm Vaporizers available in gas-fired or oil-fired models, 33,000 to 2,000,000 BTU per hour.

Representatives in all Principal Cities

McKee Eclipse

ECLIPSE FUEL ENGINEERING COMPANY

If it's for Gas—buy Eclipse

CONVENTION PAPER ABSTRACTS

CONTENTS

MILL WASTE COULD OFFSET PROTEIN SHORTAGE

More than 150,000,000 lb. of high-grade yeast and cattle fodder could be obtained from waste liquors discharged annually into the nation's rivers and streams by the mills. Besides producing this high-protein food, the waste-utilization project would reduce stream pollution by 40 percent and thus curb the annual loss of fish from this cause.

Protein as it occurs in a beeksteak or in yeast is actually a combination of amino acids. The absorption of the latter into the blood stream is the normal method by which food protein is transformed into body tissue protein. Yeast, whether made from pulp or wood waste, or by other methods, contains all the essential amino acids for human or animal nutrition. This is contrasted with cereal proteins, which tend to be deficient, thus producing poor results of growth when used alone.

In addition to the 150,000,000 lb. of yeast which can be produced from pulp wastes, a practically inexhaustible amount can be made from sawdust, wood waste and unsalable wood. Forests will be regarded more and more as suppliers of many human wants, as contrasted with exhaustible mineral and petroleum.

R. S. Aries, Northeastern Wood Utilization Council, before Division of Industrial and Engineering Chemistry, American Chemical Society, Atlantic City, April 11, 1946.

DESALTING PETROLEUM WITH FIBERGLAS PACKING

During the past five years the concentration of inorganic salts in crude petroleum delivered to refiners has increased sharply. Essentially all of the salt is in a fairly concentrated aqueous solution which is emulsified in the oil. Today salt contents in excess of 200 lb. (expressed as NaCl) per 1,000 bbl. of crude oil are common. The increase in

salt concentration has been accompanied by rapid corrosion of refining equipment as well as deleterious effects on the refining processes themselves.

An investigation was carried out to determine the feasibility of using bed of fine glass fibers for desalting petroleum. The process consists briefly of (1) contacting the crude oil with water at a temperature over 250 deg. F.; (2) passing the oil and water through beds of glass fibers of 0.00028 in. in diameter to coalesce the emulsified water, and (3) separating the desalted oil from the aqueous phase. The water phase is recycled to conserve heat. Only sufficient fresh water is used to maintain the salt content of the recycled water at a maximum of 3 percent by weight.

It has been found that salt content can be reduced to less than 5 lb. per 1,000 bbl. of oil by proper control of temperature, superficial velocity, density of the Fiberglas beds and total depth of the beds. In general, temperature should be at least 275 deg. F. for best results. Maximum permissible superficial velocities ranged from 0.25 to 1.0 ft. per min. which depend on the type crude oil being desalted. The effectiveness of the Fiberglas Packs increased rapidly with increasing density of the beds up to about 15 lb. per cu. ft. A total depth of the beds of glass fibers of 5 in. is adequate for desalting to less than 5 lb. per 1,000 bbl. About 90 percent of the salt is removed in the first 2 in. of bed depth.

The process is effective and appears to be quite attractive from an economic standpoint for commercial application.

T. A. Burtis and C. G. Kirkbride, A. and M. College of Texas, before Houston Regional Meeting, American Institute of Chemical Engineers, Houston, April 2, 1946.

WASTE OF SCIENTIFIC MANPOWER

ABILITY to do creative scientific research is rare indeed, although it may be more widespread than many have thought possible. An interest and ability in any phase of technology, science, medicine and allied fields is to be cherished.

Yet what did we do with this ability during the war and what are we doing now?

There is and will be for some time an appalling shortage of scientific manpower, thanks to decisions at top and lower levels during the war. In some fields training was cut down as early as 1940. Progressively the flow of trained manpower in science was reduced, just when the greatest results of science applied to war were beng rushed to the battlefields. Can it be that democracies, too, in their ignorance, have no need of scientists?

Scientific manpower is being wasted in time of peace. Some of the most essential young men in the great war projects of the OSRD have been rescued from the postwar draft only with great difficulties. Some have been swallowed up ruthlessly in the postwar Army. Such is the gratefulness of our nation! Such is our national ignorance. Such is our unappreciation of whence comes our strength for recovery from war.

This abuse and misuse of potential scientific manpower is continuing. Selective service boards in their eagerness to fill the ranks of occupation armies are snatching young men, regardless, when they reach 18. The war is won, and we have no need of doctors,

engineers and scientists! That seems to be their attitude. The possibility of a science-talented young man getting to college promptly for training for great future usefulness is less promising in many cases than it was during the war.

Even worse is the lack of any wide-spread serious effort to persuade science talented youth to do something about their potentialities in the interest of civilization. We are told that there is a shortage of 15,000 scientists in the land. This is far more serious than a shortage of sugar or wheat in the world, and it gets much less thought and attention.

As a consequence of the enaction in Congress upon the science foundation bills and because so much effort has been expended in trying to keep fundamental science out of the clutches of the military, this major problem of the continuing supply of scientific personnel has all but been neglected.

If we are to have enough scientists in the future to do the needed fundamental basic research that must be government- and foundation-supported in non-commercial research laboratories, and to fill the beautiful and monumental research laboratories that industries are building in such magnificent profusion, much must be done immediately.

The very essence of our scientific continuity is contained in the stores of our accumulated scientific knowledge, whether these be in our libraries of technical and scientific literature, our patents, our secret war archives or in the minds of men. War has mussed up the channels and disordered the files and a major job in scientific and technologic reconversion is the bringing of all the modern methods we can devise to work upon this problem of scientific communication and intelligence.

Watson Davis, Science Service, before American Association for the Advancement of Science, St. Louis, March 27, 1946.

IMPROVEMENT OF KARBATE MATERIALS

An initial report on the development of Karbate equipment was given before the American Institute of Chemical Engineers in 1939. Commercial use since then has proved the usefulness of the basic material, but, naturally, has brought out the need for certain improvements.

The base stocks which form the continuous structure of Karbate stock are slightly permeable. Resin is deposited in the pores for the purpose of rendering the stock impermeable and increasing strength. It does not change thermal conductivity. Considerable advances have been made in developing and utilizing new resin impregnents which will accomplish these purposes without limiting the corrosion resistance or useful temperature range of Karbate stock any more than necessary.

The first resin employed—and the one still used in greatest quantity because of wide corrosion resistance and ease of handling—was a furfural type. This resin has proved quite satisfactory, except at elevated temperatures. The temperature range has been extended by two other resins. One of them is a phenolic resin which may be used up to 340 deg. F., and which has corrosion resistance similar to the furfural resin. The third, a modified phenolic, is used rel

atively infrequently, but was selected to meet certain extreme corrosion conditions such as those encountered with concentrated caustic and certain oxidizing acids. Karbate stock impregnated with this resin is also recommended for the 340 deg. F. temperature range, and under proper conditions may be used up to 400 deg. F. Thus, from a single resin, the grades of Karbate have been extended to cover more and more of the severe corrosive conditions encountered in industry.

Equipment is usually fabricated from Karbate stock by cementing the parts together. In this way large tanks or towers are built up from slabs of impervious stock, tubes are sealed into their tube sheets, pumps are assembled, etc. The bonds are normally stronger than the stock. A variety of bonding agents has been employed, but by far the best are the special cements whose development has paralleled that of the resin impregnates. Three cements are available and are quite similar in chemical makeup and corrosion resistance to the three impregnants. These are particularly valuable in the field for final assembly and repair work. All three bonding materials will set up at room temperature, but the curing time may be shortened by application of heat.

Along with the improvements in resins have come improvements in the quality of the structure of the base materials. Stronger, more uniform stocks suitable for impregnation have been developed. Simultaneously has come increased size of parts, including tube sheets, tower sections, and many others. For example, pipe was originally made in 6-ft. lengths. To meet the requirements of heat exchanger equipment the more popular sizes are now available in 9-ft. lengths.

M. R. Hatfield and C. E. Ford, National Carbon Co., before the American Institute of Chemical Engineers, Chicago, Dec. 19, 1945.

GERMAN DYESTUFF RESEARCH

THE I. G. employed approximately 800 research chemists in the field of dyestuffs and intermediates. Not more than approximately 5 percent of these research workers were engaged in studies of color application and properties of dyestuffs. The remainder were engaged chiefly in the synthesis of new dyes and intermediates, the development of manufacturing processes, and improvement of existing products and processes. This appeared to be a rather poor balance in effort; and this same opinion was expressed by more than one I. G. man in the course of various interviews. The policy of concentrating on new products with little emphasis on application was ascribed chiefly to the fact that most of their executives formulating policies were organic chemists and, therefore, primarily interested in purely chemical development of new dyestuffs and intermediates. Furthermore, they were extremely aggressive in developing new products, especially those which could be protected by patents; and which, through their sale, would result in a direct monetary return to the organization. They were nowhere near as enthusiastic about expending efforts to develop better application processes for their customers, especially in view of the fact that such processes might result in lowered dyestuff requirements. On the other hand, the

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organization did do a very thorough job of determining the properties of their colors; and they were especially capable in developing trade literature and handbooks for consumers. Here again, however, it was obvious that one of the important motives was the sales promotion of all their own products, including both dyestuffs and auxiliaries.

As to the caliber of their research personnel, it was our opinion that they were highly experienced but in general far from brilliant in new ideas. Their productivity insofar as as new dyestuffs were concerned seemed to be due more to mass effort than to individual brilliance.

Lengthy processes involving considerable labor were not particularly important problems to them. They normally had an abundance of intelligent workers, paid at so much lower a rate per hour than prevails in this country that they could afford to do many things which would be economically impossible here. Perhaps we shall find that some of the specialties imported prewar from Germany cannot be produced in the United States at the prewar selling prices, due to our higher labor costs. Their equipment in both laboratories and dyestuff plants was far from modern by American standards. Evidently their low labor cost made it advantageous to spend money on operating labor rather than to make extensive investments in modernized equipment.

Our American research workers in the dyestuff field certainly do not suffer by comparison with their I. G. contemporaries. On the average our research people must be two or three times as productive on a man-for-man basis as the I. G. group.

From a "quality" point of view, American research is superior and this applies likewise to control of quality and uniformity of the final products in manufacture.

As to new developments in color application, it must be said that there was far less interest in Germany than is current in the United States at the present time.

Miles A. Dahlen, E. I. du Pont de Nemours & Co., before American Association of Textile Chemists and Colorists, New York, January, 1946.

CHEMICAL ENGINEERS AS CITIZENS

THE chemical engineer cannot help being a very practical sort of scientist. It is his responsibility to carry the developments of the laboratory into the stage where they become available to and of tangible benefit to the ultimate consumer. So, it follows, it is the chemical engineer who is in continuous contact with the layman, and it is the factories and the products and the processes of the chemical engineer which the layman is most likely to understand.

A designation of the research worker in the laboratory as "the long-haired boy"—conveying the idea of a detached and perhaps impractical and cloistered seclusion—even though said half in jest—can never be even remotely descriptive of the thinking of the chemical engineer and his approach to his problems. This situation makes it especially incumbent upon the chemical engineer to see to it that the laity have a true concept of the part which applied science plays or may play in their lives.

If the world that our families and you and I must live in were truly and solely the prod-

uct of our efforts and the result of our thinking, would it be a better world in which to live? Would the basic moralities, upon which even the most ordinary and rudimentary approach to right living must depend, be inculcated more generally in the training of our youth? Would justice and a consideration for the other fellow be a much more prominent feature of the political landscape than it is today?

If the answer is "yes"—and it must be yes—if we are not consciously shirking our most ordinary responsibilities, not to mention those of the good citizen, then why are we not now more personally and intimately concerned with the effort to bring about these desirable conditions in the world as it is?

Perhaps this whole question is closely bound up with our realization of the obvious fact that you and I are an indissoluble part of the body of unorganized citizens who are comprised in no pressure groups, told by no bosses what we are to think or how we are to behave, and who have no private axes to grind surreptitiously upon the public grindstone. We are a part of the Public. Consequently we are of course concerned with all the conditions which determine our daily living. If we have a contribution to make to the public thinking from our specialized training, or from our broad knowledge of a wide variety of manufacturing processes, then by all means let us be sufficiently interested in questions of the public welfare (synonymous with our own) to make these contributions, for they are most valuable to the comprehensive and informed thinking upon which alone are based accurate answers to questions of this nature.

C. M. A. Stine, vice president of AIChE, before Philadelphia-Wilmington Section, American Institute of Chemical Engineers, Wilmington, Jan. 18, 1946.

THE MADISON WOOD-SUGAR PROCESS

A PROCESS, known as the Madison wood-sugar process, has been developed by the Forest Products Laboratory for hydrolyzing mixtures of wood waste consisting of chipped slabs and edgings, sawdust, and shavings, with 0.5 to 0.6 percent sulphuric acid at temperatures of 150 to 180 deg. C. by allowing the dilute acid to flow continuously through the charge of wood.

Compared with the German Scholler process, hydrolysis was accomplished in less time because the sugars produced by the hydrolysis were removed more rapidly. Heating was at a lower rate and more efficient use could be made of the heat given off by the liquors being removed from the hydrolyzer, resulting in a lower steam requirement. Decomposition was less because the sugars were in contact with the acid for a shorter period of time and, consequently, yields of sugar and alcohol were higher. Fewer by-products inhibitory to fermentation were produced, resulting in more rapid fermentations. Life of valves and other equipment was increased because they were set once for the run and not changed until the end of the run. The sugar produced in 2.8 hr. from a ton of dry, barkfree Douglas fir wood waste yielded 64.5 gal. of 95 percent alcohol as compared to 3.2 hr. for 58 gal. by the rapid-cycle method developed earlier, and 13 to

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With hydroxy compounds—

$$R\text{-}OH + CH_2 = CH\text{-}CN \rightarrow R\text{-}O\text{-}CH_2\text{-}CH_2\text{-}CN$$

Included in this group are alcohols, phenols, and oximes...

With ammonia or amines—

$$RR_1NH + CH_2 = CH\text{-}CN \rightarrow RR_1N\text{-}CH_2\text{-}CH_2\text{-}CN$$

R and R_1 can be hydrogen or an aliphatic, aromatic, alicyclic, or heterocyclic radical...

With compounds containing active hydrogens—

$$RR_1R_2CH + CH_2 = CH\text{-}CN \rightarrow RR_1R_2C\text{-}CH_2\text{-}CH_2\text{-}CN$$

This group includes ketones, aldehydes, and esters...

Acrylonitrile will also react with halogens, mineral acids, compounds containing conjugated double bonds and numerous others.

The cyano group in acrylonitrile, or its derivatives obtained by the reactions outlined above, will undergo any of the typical nitrile reactions such as hydrolysis to an amide, acid or ester; or reduction to an amine.

AERO ACRYLONITRILE is a highly refined chemical. The boiling point of the pure compound is 77.3°C. It weighs about 6.7 pounds per gallon. It is miscible with most common organic solvents but only slightly soluble in water.

Further technical information regarding the reactions of acrylonitrile and samples of the material are available. Write to the Synthetic Organic Chemicals Department of the American Cyanamid and Chemical Corporation, 30 Rockefeller Plaza, New York 20, New York.

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20 hr. for 55 gal. by the Scholler process as practiced in Germany.

These new findings indicate that the estimated capacity of the wood-hydrolysis plant being built at Springfield, Ore., may be increased from 4,100,000 to 5,950,000 gal. per year.

E. E. Harris and E. Beglinger, Forest Products Laboratory, before Division of Cellulose Chemistry, American Chemical Society, Atlantic City, April 11, 1946.

COTTRELL PRECIPITATOR DEVELOPMENTS

FUNDAMENTALLY the principle of the Cottrell Precipitator is the same today as that established by Dr. Cottrell about 1905 but there have been, of course, marked changes in technical and engineering features as well as new developments and improvements in order to meet the requirements of modern industrial applications.

Precipitators are applicable to problems covering a wide range of conditions. They can be employed for the removal of almost any kind of liquid or solid particles from practically any gas with no lower limit on particle size. The temperature may vary from atmospheric to as high as 1,100 or 1,200 deg. F. on certain applications and at least one installation operates at 125 psi. ga. pressure. Efficiency of removal can be varied to suit requirements irrespective of inlet concentrations, but for economic reasons it is usually specified between 90 and 99.9 percent.

Power consumption is quite nominal usually, ranging between 3 and 5 kwh. per million cu.ft. of gas cleaned, while the pressure drop between inlet and outlet is less than ½ in. of water.

Development and improvement in design and details are being made continuously. Among such developments may be cited: (1) Development of so-called half wave rectification with resultant reductions in the amount of electrical equipment required and in power consumption; (2) air-swept insulators or insulator compartment ventilation to prevent excessive dust and moisture deposits or excessive temperature of insulators; (3) oil seals for insulator compartments to prevent deposition of materials on insulators for certain types of applications; (4) water flushed pipe type precipitators for continuous cleaning of collecting electrodes in certain installations; (5) utilization of hot cathode tube rectifiers on certain applications and location of transformers and rectifiers in metal containers at precipitator instead of substation; (6) development of combination collector for carbon black industry including precipitator for agglomeration followed by cyclones; (7) addition of conditioning agents (e.g., a trace of ammonia gas in approximately 1 part per 10,000 to flue gas in one general application) to improve precipitator efficiency.

In addition to the above, numerous other innovations, developments and improvements in design, construction and operation have been made over the past years in order to better adapt the equipment to the requirements of industry.

Application of the Cottrell equipment in the chemical industry is quite extensive, including such standard applications as detarring manufactured gas and cleaning of gases from roasters, sintering machines, cal-

ciners, blast furnaces, gypsum kettles, recovery furnaces in pulp mills, carbon black furnaces, phosphorus furnaces and regenerators in fluid catalyst units in the petroleum industry.

C. E. Beaver, Research Corporation, before the American Institute of Chemical Engineers, Chicago, Dec. 17, 1945.

ELECTRONICS IN CHEMICAL FEED SYSTEMS

CONTROLLED volume chemical pumps may be used for accurate metering transfer of liquids in chemical processing. These pumps are normally driven by standard alternating current constant speed motors. By employing an electronic controller, alternating current is rectified to control speed of a direct current drive motor, the speed of which is constant at a given potentiometer setting from zero to full load. The speed of the motor determines the exact speed of the pump. The quantity of chemical delivered by the pump is directly proportional to pump speed, therefore a control of motor speed is a direct control on quantity of chemical feed.

A 10,000-ohm potentiometer is required for regulation of motor speed. The motor speed follows a straight line relationship with potentiometer setting. This potentiometer may therefore be mounted in any metered circuit to give automatic control of chemical feed in accordance with the metered variable. Application of this system has been made for automatic proportioning and for pH control Applications are contemplated using temperature, pressure, liquid level, or conductivity as the metered variable.

Robert T. Sheen, Milton Roy Pumps, before American Institute of Chemical Engineers and Water Committee of the Technical Association of the Pulp and Paper Industry, New York, Feb. 25, 1946.

HOW JAPAN EXPANDED HER INDUSTRIES

JAPAN, with no indigenous sources of coal of grades suitable for making metallurgical coke, has 40 percent of the ovens in non-Soviet Asia for making such coke. She has no economical ores of aluminum or magnesium, yet has about half of the manufacturing facilities. She has well over three-quarters of the chemical equipment and slightly less than three-quarters of the electric equipment. She had even a larger proportion of merchant shipping.

It is easy to look at these rather startling figures of Japanese basic industrial power and to credit it merely to the superior education and training of the Japanese. But that is too easy an answer, because the training and abilities of the Japanese have been devoted not only to increasing their own industrial might but also to suppressing the industrial strength of their neighbors. When it became necessary to draw upon the manpower of the conquered areas, Japan held this development pretty largely to the more primary stages of manufacture. The conquered territories thus were made dependent on Japan for markets for the cheaper products. While this was going on, Japan expanded her home island capacities and trained her own labor in the more skilled steps of manufacture which added a larger portion to the value of the final commodity.

By exporting manufactured products at

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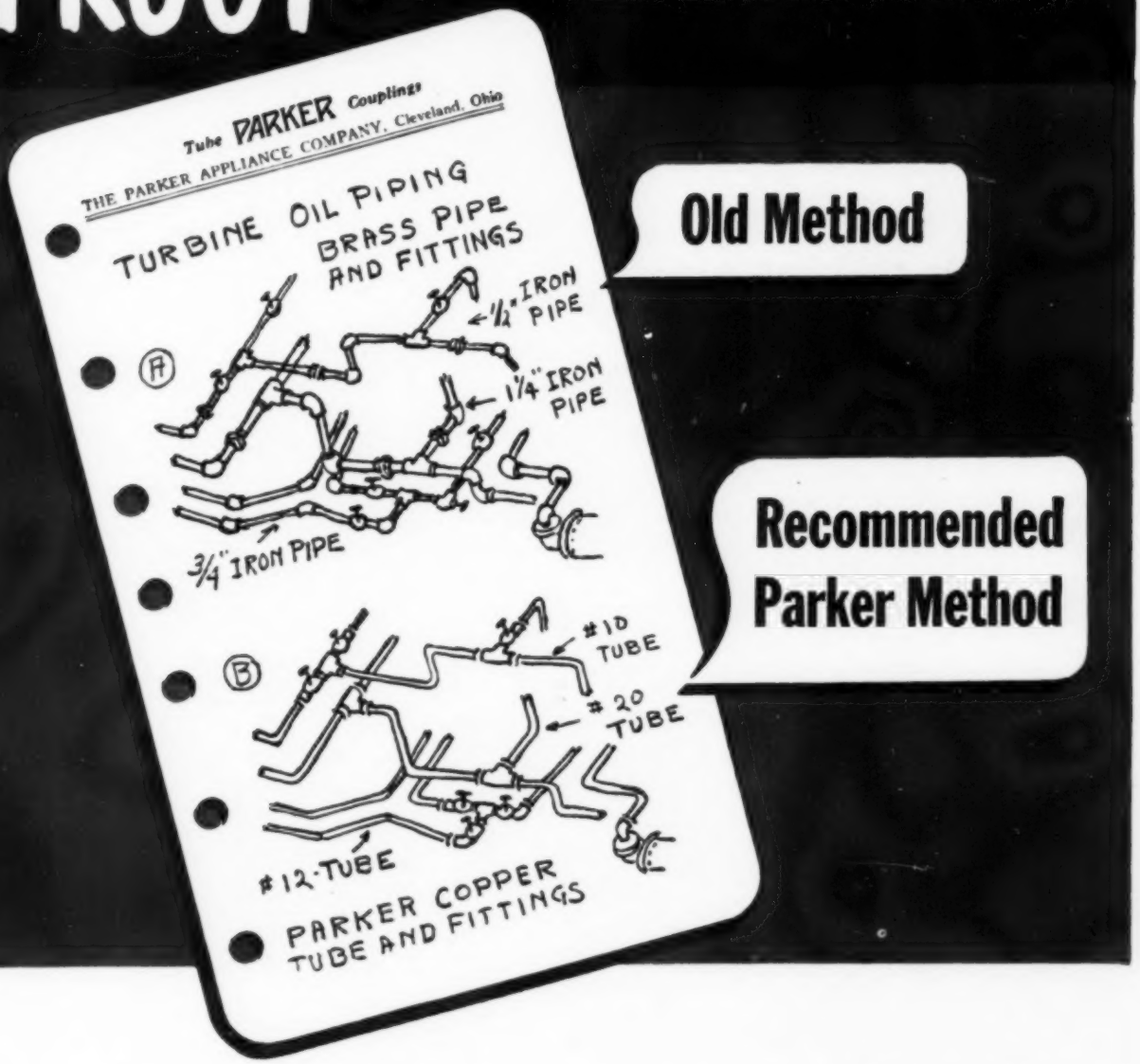

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very low prices, Japan made Asia increasingly dependent on Japanese industry and at the same time encouraged expansion at home. Low-priced exports were made possible because of the very low prices paid Japanese labor, and also through such devices as inflation, subsidy, confiscation and coercion. Profits at home were guaranteed by cash grants, price fixing, preferential shipping rates and tax preferences, which were paid for by consumers and smaller taxpayers. Since this was accompanied also by a great centralization of ownership of productive facilities in the so-called Zaibatsu of Japan, these owners prospered and grew. But the Japanese people themselves were unable to afford the goods and services which normally would be available to a population of a country industrialized to the same degree.

When this expansionism created unendurable drains on Japanese foreign exchange balances, territories with natural resources were gradually brought into the Yen area and industrial expansion under Japanese ownership was started in these territories. And despite the tribute obtained from the conquered areas, the people had to tighten their belts more and more as the war lengthened.

Thus we find at the end of the war a far-reaching dependency on Japan for outlets for natural resources, and for supplies of finished products. Unless this dependency is reversed, most of the rest of Asia will be in no shape to resist possible future Japanese aggression, economic or military.

Martin T. Bennett, Washington, D. C., before American Academy of Political and Social Science, Philadelphia, March 18, 1946.

STATISTICAL METHODS IN QUALITY CONTROL

In the past 20 years industry has been gradually adopting statistical methods as a practical means of obtaining quality and production control. With the advent of the war in 1939 and the rapidly increasing demand for more and more good products in the shortest possible time, engineers have been increasingly anxious to use every means at their disposal not only to produce more but to obtain an increasingly larger percentage of good product. This increase in the proportion of good product can be obtained only by maintaining a high and consistent level of quality in all related operations. The statistician dealing with quality control in a manufacturing plant of practically any description finds, almost before he can realize the fact, that he has changed from the status of statistician to that of quality control engineer.

In any industry producing material by repetitive processes, constancy of the factors involved is not obtained. The numerous variables associated with quality and production occur with more or less mathematical regularity about any one desired value. Generally, the desired value is the most frequently encountered, with values on either side occurring with less and less frequency between certain limits which can, in most cases, be determined by statistical methods.

Regardless of the characteristic shape of any curve, there is one thing which should be known about any distribution, and that is whether or not it takes its shape from a chance or nonchance system of causes. To

determine this fact correctly is one of the important tasks of the quality control statistician.

Chance causes may differ from time to time so that a distribution of any one variable will have a different form in one period than in another. As time progresses, an element may periodically enter and leave the system. A factor may appear in different magnitude from time to time, depending upon previous processes, or a completely new factor may enter or an old established factor leave the system. Regardless of these situations, one thing is constant whether statistical control is practiced or not, and that is, that in every manufacturing process the manufacturer aims for a definite mark in controlling all of his processing variables to the end that the most satisfactory product may be made with the greatest economy.

Frequency distributions are not suited to the routine analysis of observed data in a manufacturing process. If one wishes to know the whole story relative to the chance or nonchance occurrence of observed values, the control chart is of inestimable value, in that it tells: (1) The state of statistical control; (2) the evidence of more than one level of control; (3) the existence of nonchance causes; (4) the existence of cycles or trends.

By setting up statistical relationships based on reliable past experience, statistical methods of control are not only practical but are a valuable adjunct to any control program.

W. T. Rogers, National Tube Co., before American Society for Metals, Cleveland, Feb. 4, 1946.

FACTORS IN BUILDING A NEW EXPORT BUSINESS

Many companies in the chemical industry and in other fields are beginning to be interested in starting a new export business, or else broadening the scope of their present international activities. It seems timely, therefore, to outline briefly some of the factors which are important to such an undertaking.

Everyone knows that the ultimate aim of any business is to make a profit. It is also true that many products are often sold abroad at less actual profit than that earned in the domestic market. This statement should be analyzed, however, with the understanding that there are many indirect expenses in the domestic market such as advertising and various consumer service items, which while they are not usually charged to selling expense, actually do have a bearing on sales volume. The important conclusion to be drawn is that the percentage of profit alone should not be the only consideration when it is decided to begin or to expand in the export field.

New export markets should be entered with the definite aim to obtain and hold a fair share of the available business. Once it is decided to enter these new markets, enough goods should be allotted to accomplish this purpose, otherwise it is probably much better to stay out. Some companies in this country will have much more interest in export at some future date when they discover that their domestic sales are beginning to decline. It will be much too late then to decide to start or expand an export business. Many businessmen in South Amer-

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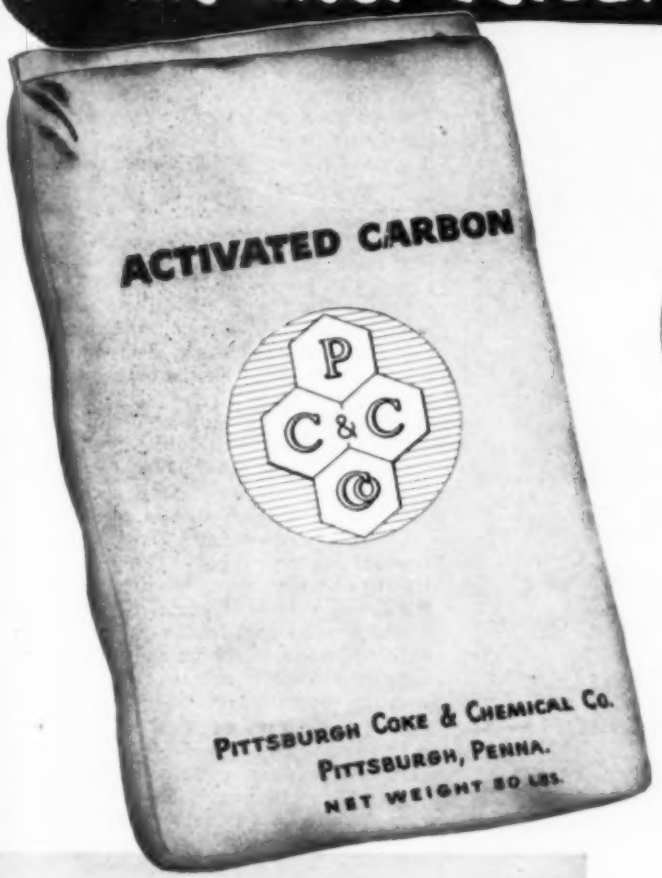

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ica believe that one dollar in American goods which is shipped now, would probably be as effective in holding the market as five dollars in goods which might be shipped to them five years from now.

It is good practice for any company to agree on certain definite percentages of its production for export for at least a period of twelve months. This figure can then be reviewed at the end of each quarter, and revised if necessary. If this is not done, it is impossible to plan intelligently an effective export program.

A firm which has even a very limited export business is familiar with the necessity of protecting their trade-marks and patents in all important foreign countries. The usual method is to retain the services of a legal firm, with international connections, who specializes in this type of work. Considerable help can also be obtained through the advice of legal counsel which may be retained by distributors or agents in their respective countries. If the size of the business warrants it, the legal services of a local firm in certain foreign countries may be justified on a direct basis. In many cases this would not cost any more than other methods and it might yield better results.

If we assume next that it is necessary to make a preliminary survey of certain new markets, and possibly also in regard to markets which may be expanded, then the best policy is to have some well qualified official of the company visit these places and bring back a first-hand report. The alternative is to employ some outside organization, such as an advertising agency with international connections to do this job. The experience of most companies indicates that better results are obtained when this type of job is done by a responsible member of their own organization and this usually does not cost as much as the method of employing an outside group.

E. M. Melton, Ansco Division of General Aniline & Film Corp., before Chemical Market Research Association, New York, Feb. 14, 1946.

PROFESSIONAL PROBLEMS

ENGINEERS of the country are faced with a number of problems due to the rise of labor unions and their further extension of union influence in industrial relations. The problems of the chemical engineer are those of all engineers and can only be separated in a few specific details which are not of vital importance in the broad picture.

In recent years the impact has been advancing at an accelerated pace so as to be, at the moment, a very pressing matter. So long as the labor unons were confined to the hourly workers in a plant, the impact on the engineering profession was negligible and involved principally their relations with the workers rather than their own relations as workers. Unions now however, include all sorts of white collar employees and there are unions which purport to be representatives of technical groups including both the professionals and the technicians who serve them. The Federation of Architects, Engineers, Draftsmen and Technicians is a good example of this type of union. They are attempting to include the professional worker and in isolated cases have done so through the medium of the closed shop. The situation is more than academic and if

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chemical engineers are to maintain their true professional status they must stop disregarding the tide of affairs and indulge in positive action.

When we come to professional engineering however, the question of hours and rates hardly applies in any usual trade union sense. True professional engineering is creative work and the difference between two individuals can be so great as to be a difference of kind rather than a difference of degree. No uniform standard could ever be adopted which would be fair to the average without tremendously penalizing the highly creative workers. Further, creative work knows no hours. A professional man thinks about his job whether he happens to be in the plant or home taking a shower. Strict limitation of hours is meaningless in this respect. This type of work is not susceptible of handling by the usual criteria of trade unions.

It therefore seems inevitable that the handling of employer-employee relations, insofar as professional men are concerned, must be solely in the hands of the professional employees themselves if conditions of employment are to be discussed with the management. Professional objectives are such, that they could not be attained through representation by a heterogeneous trade union, but as things are developing, this is the way in which these problems will be handled if the engineers do not take steps to protect themselves, and their status as professional men.

One difficulty is that all engineering graduates do not become professionals. Many of them remain merely technicians, the draftsmen and the laboratory analyst are examples of such technicians. With such types it seems probable that trade union methods may prove more effective than methods designed for the needs of the truly professional group.

In order to make progress, the first thing we must have is a clear cut distinction between the professional and the technician. This definition must be a legal one and not one prepared by self-constituted bodies such as any of the engineering associations and their membership requirements.

There is a quantity of work to be done in all the states in welding the chemical engineers together as a true professional group and in their combining with local groups of other types of engineers, preferably through the society of professional engineers to safeguard the inroads that are being made on the individual rights and freedom of the professionals. If our laws are such that engineering employees must bargain with the employers through a bargaining unit, let it be a bargaining union of engineers and solely professional engineers. In such a unit the question of wages would be merely one of a minimum wage for a full professional engineer and a minimum for an engineer in training at the outset of his career. Quite a few of the state societies of professional engineers are setting up standards in this regard, one for private employment and one, somewhat lower, for public employment under civil service rules. More than this would not be necessary, because we cannot place a ceiling upon the value of professional services.

The question of hours should not enter into the picture at all, so that bargaining, if

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necessary, would take an extremely simple form and be of a very different nature than that carried on by a trade union. Such purely professional matters as credit for discoveries, rights to publication and the like would be a very much more popular question than wages or hours.

When all that is said and done, the engineer belongs on the managerial side of industry. Anything that would place him in the trade union status with trade union requirements would stifle initiative and stop development. It would indeed be to the disadvantage of the trade unions themselves, if the developments which increase productivity and employment were strangled at the source. The leaders of the trade union movements know that the future of the country and themselves depends on scientific and engineering development. They also must know that such creative work cannot be standardized to meet trade union norms. May the professionals work together to approach their ideals in concert, not in opposition to trade unions, but apart from them. If they do not do so, the rising tide will engulf them to the ultimate detriment of all.

John M. Weiss, John M. Weiss and Co., before American Institute of Chemical Engineers, Baton Rouge, Mar. 21, 1946.

CAN CORPORATE RESEARCH PATENT INVENTIONS?

IN A recent decision it was held, in effect, that it was doubtful whether an invention could be made in a corporate research laboratory.* If an invention were asserted to have been made, it would have to be proved that it required more than the exercise of the inventive faculties of the experts in the laboratory in question. The decision stated that, prior to the development of the corporate research laboratory, the circumstances under which an alleged invention was made were not ordinarily examined; but today, where the record shows that the real party in interest is the owner of such a research laboratory, then it must assume the burden of proving the presence of inventive genius with evidence disclosing the level of the art in the research laboratory at the time the patent application was made. It is further asserted that this is only a recognition of the obvious fact that some further proof be made beyond the blue-prints and specifications in the patent application with respect to the products of the laboratory. In the specific case in question, the court held that these circumstances, in the absence of evidence of individual achievement, create at least an inference that the alleged invention is a step-by-step improvement, the result of skill and experimentation in the use of existing knowledge, and not in invention. In other words, the court felt that because the invention was made in a corporate research laboratory, it was necessary for the company to prove things which the ordinary individual inventor does not have to prove. Such additional proof is not required by the patent law but has been the product of judicial legislation. As a result of this reasoning, the court held that the inventor did not make an invention which was patentable. Accordingly, it would be desirable for your laboratory records to contain evidence that the researcher has made an invention and

* Potts vs. Coe.

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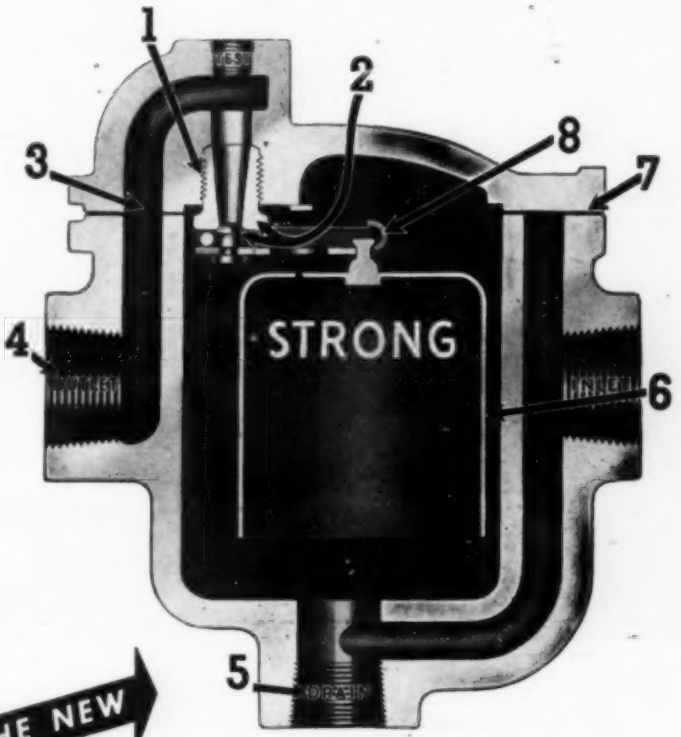

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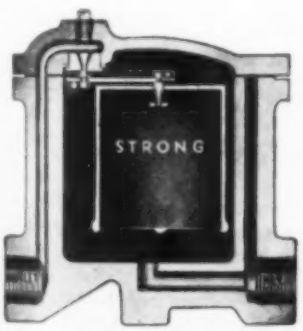

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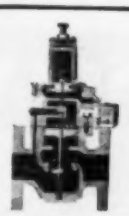

Reducing Valve

has exercised his inventive faculties beyond the skill of the experts in the laboratory. Furthermore, the records should show that the researcher has made a contribution to the art and has added an increment of knowledge to the existing knowledge, not only in the art but in the laboratory itself, and that such increment which had been contributed was not obvious to the experts in the laboratory and required more than the ordinary skill of such experts as well as others in the art.

A. W. Deller, The International Nickel Co., before Graduate Division of New York University College of Engineering, Dec. 20, 1945.

FRICTION BETWEEN SCIENTISTS AND MILITARY MEN

THIS country has been engaged in two major conflicts within the space of about 25 years. In both instances, we had allies who held off the enemy until we were ready, and we were on the side which had an enormous preponderance in manpower, in natural resources, and probably also in technical knowledge.

If we do engage in future wars, we may not always be lucky enough to have such enormous advantages, and it may be necessary for us to be more economical of our manpower and our resources.

It is therefore imperative that the nation examine its recent war effort to determine whether it did things well or whether its resources were such that it had to win no matter how many mistakes were made.

An example of the way scientists and the military should cooperate was presented by the relationship between units of the Office of Scientific Research and Development and the Chemical Warfare Service. By the end of the war OSRD personnel were stationed at many Army posts, some OSRD representatives held positions on the staffs of general officers, and in many respects the civilian and Army programs had been fused into one coordinated whole. It should not be implied that friction was entirely absent, but it is safe to say that few instances exist of more whole-hearted and complete cooperation.

W. A. Noyes, Jr., University of Rochester, before Virginia Section, American Chemical Society, Jan. 18, 1946.

ELECTRONIC POTENTIOMETERS

THE INCREASING application of the self-balancing recording potentiometer to chemical processing has been brought about largely by the advent of basic improvements in their detecting and rebalancing mechanism. One improvement is the direct result of using electrical means other than the conventional galvanometer for detecting changes in the measured variable. Further improvement resulted from the replacement of the cyclic rebalancing mechanism with an electronically controlled motor continuously rebalancing the indicating or recording system to correspond to changes in the measured variable.

Such variables as temperatures, pH, high vacuum, spectographic quantities, mechanical strain and rotative speed are particularly susceptible to measurement with this type of continuously balancing potentiometer. It is to be expected that even other variables will be measured to greater advantage with these

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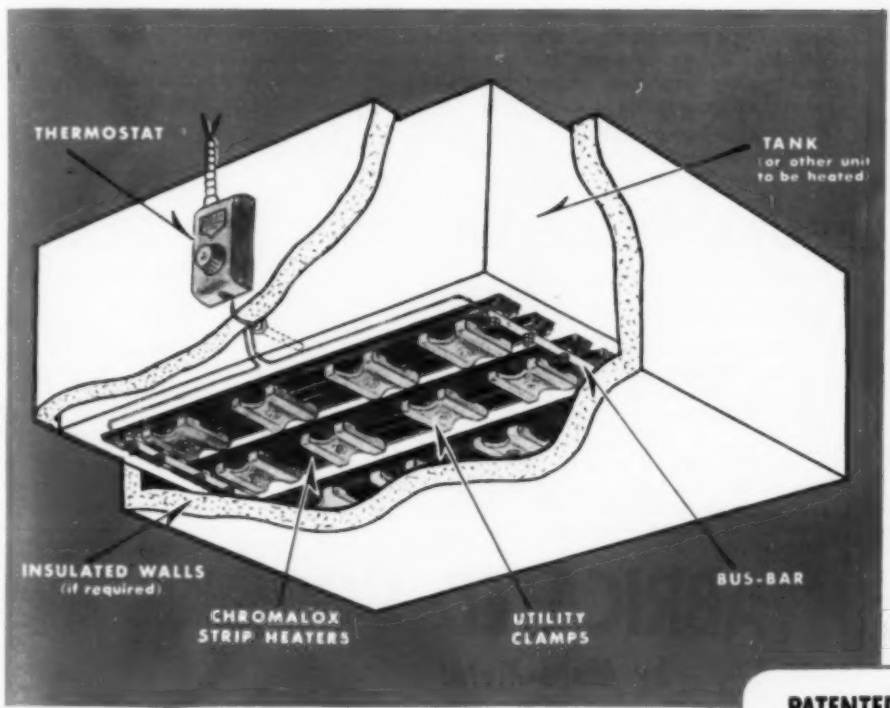

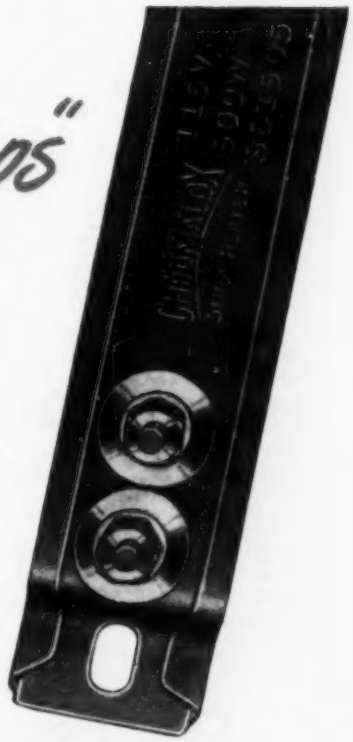

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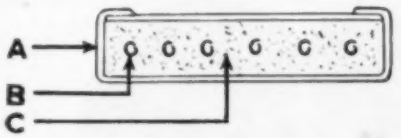

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newer instruments where speed and accuracy are essential. Higher speed of operation, down to approximately four seconds across full scale for many of these instruments, has brought about the first really adequate measurement of multiple temperatures. Temperature measuring instruments indicating as many as 48 separate points with speed and precision allow scanning of a chemical unit operation as it has never been done before.

Greater sensitivity of measurement has been accomplished in these newer types of self-balancing recording potentiometers through improvement in the rebalancing mechanism. In most cases positive detection of changes as small as 0.03 percent of full scale is guaranteed and the sensitivity of measurement is sometimes better than this figure. On a pyrometer calibrated from 0 to 300 deg. F., for example, this sensitivity would allow consistent measurement of changes in temperature as low as 0.09 deg.

The advantage of this great sensitivity is apparent where it is desired to measure process variables which change slowly, such as fractionating column temperatures. In such measurements a sensitive instrument will sense a temperature change in one-half the time required for an instrument with one-half the sensitivity.

From the standpoint of maintenance, these instruments are easier to service and more simple to maintain. The use of electronic and electromechanical components has virtually eliminated the multiplicity of mechanical moving parts. Longer life is thereby attained because of their reduced wear on fewer moving parts. Reproducibility is also improved as a result of reduction of wear.

The sturdiness and reliability of the electronic potentiometer have been proved in severe service. The absence of a delicate galvanometer movement and its associated parts make an instrument which in many aspects is more powerful and rugged than its mechanical counterpart.

D. M. Considine and D. P. Eckman, The Brown Instrument Co., before the American Institute of Chemical Engineers, Chicago, Dec. 18, 1945.

FOREIGN LITERATURE ABSTRACTS

PYROCATECHIN FROM WOOD CRESOTE

TREATMENT of wood creosote with aluminum chloride results in practically complete splitting of the phenol ethers of creosote without the use of an autoclave. Approximately 60 percent aluminum chloride is necessary for the almost complete splitting of the phenol ethers, which corresponds approximately to a mol to mol proportion of ether and reagent. Decreasing this proportion results in a sharp decrease in the yield of product and an increase in the content of OCH$_3$ in the residue. Splitting of the phenol ethers by means of aluminum chloride is a more rapid rejection than that resulting from treatment with aniline hydrochloride and hydrogen chloride. When aluminum chloride is used, pyrocatechin is extracted from the reaction mixture by treatment of the reaction mixture with an aque-

"conclusive evidence of service..."

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November 17, 1945

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St. Louis, Missouri

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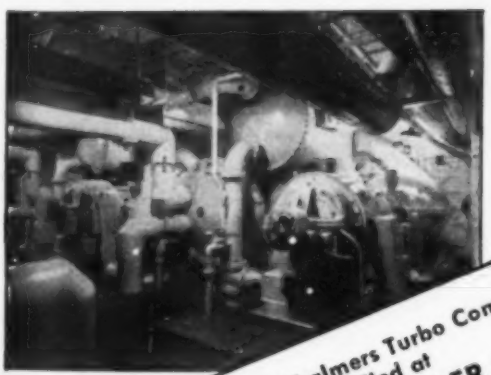
The fact that we have just recently placed an order with you for the third compressor of this type is probably the most conclusive evidence of the service that these machines have given us.

Yours very truly

W. O. Bode
General Superintendent



The YORK Allis-Chalmers Turbo Compressors as installed at
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ous solution of hydrochloric acid, but the problem of recovery of the aluminum chloride from the waste liquors has not yet been solved. Crystalline pyrocatechin is separated from the ether extract directly by vacuum distillation, which method yields a sufficiently pure product with a larger yield than treatment of the extract with a solution of sodium chloride for the purpose of preliminary separation of the monoatomic phenols.

Digest from "Preparation of Pyrocatechin from Wood Creosote by Splitting the Phenol Ethers of Creosote under Atmospheric Pressure," by B. P. Sumarokov, C. C. Ryilkin and E. E. Kurmileva, *Zhurnal Prikladnoi Khimii* **XVII**, 9-10, 552-556, 1944. (Published in Russia.)

NITRATION OF HIGH MOLECULAR WEIGHT HYDROCARBONS

HYDROCARBONS above C_8 should be nitrated at a low temperature and in the liquid phase by conducting superheated and finely divided nitric acid over the hydrocarbons. The reaction can be carried out in a special apparatus which feeds nitroparaffins simultaneously with small quantities of fatty acids. First pure hydrocarbons and then mixtures of hydrocarbons from the Fischer-Tropsch synthesis were subjected to the reaction. The most suitable temperature for C_{10} hydrocarbons is 160-180 deg. Mononitroparaffins are never formed alone without the accompanying formation of polynitroparaffins. Part of the material does not react at all, and fatty acids and ketones are obtained as a result of the oxidizing action of the nitric acid. These are readily separated. The products of the Fischer-Tropsch synthesis produce hardly any tertiary nitroparaffins, since very few branched hydrocarbons exist in the portions having high molecular weight. The mononitroparaffins are colorless liquids with a flowerlike odor and are distillable in a vacuum without decomposition up to the limit of C_{20}. n-Dodecane was also nitrated with nitric acid and nitrogen dioxide, and diesel oil was nitrated with nitric acid (200-320 deg. C.). The reaction products are chiefly secondary nitrocompounds, with a small quantity of primary nitro-compounds. Nitration takes place chiefly in the second position. This results in derivatives nitrated at the end of the chain, which is especially interesting for the preparation of compounds with active properties of capillarity.

Digest from "Nitration of Paraffin Hydrocarbons of High Molecular Weight," by Ch. Grundmann, *Chemie* **56**, 159, 1943. (Published in France); *Ion* **IV**, No. 35, 422-423, 1944. (Published in Spain.)

ACTION OF METALLIC SODIUM ON CELLULOSE DERIVATIVES

METALLIC sodium in liquid ammonia causes cleavage of the methyl ethers of cellulose with formation of desoxy derivatives of cellulose. The following derivatives have been prepared by means of this reaction. The last two were unknown until now.

$$C_6H_7O_2(OH)(OCH_3)_2$$
$$C_6H_7O_3(OH)(H)(OCH_3)$$
$$C_6H_7O_3(H)(OCH_3)_2$$

The methyl ethers of d-glucose are decomposed by the action of metallic sodium both in the cold (slowly) and with heating, and still more readily in a solution of liquid ammonia. It has been found that heating of tetramethyl-methyl-glucoside with metallic sodium, in the determination of the mole-

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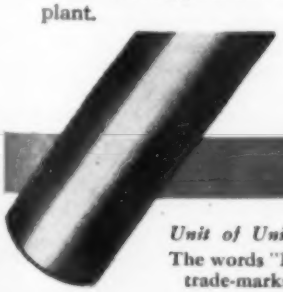

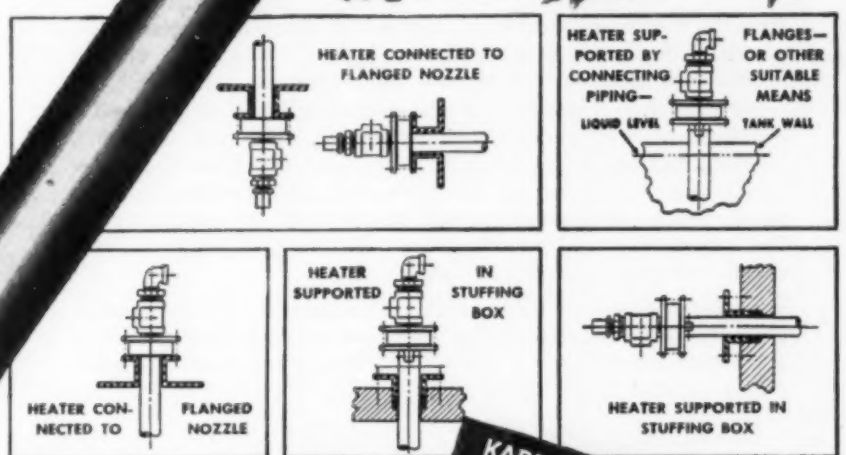

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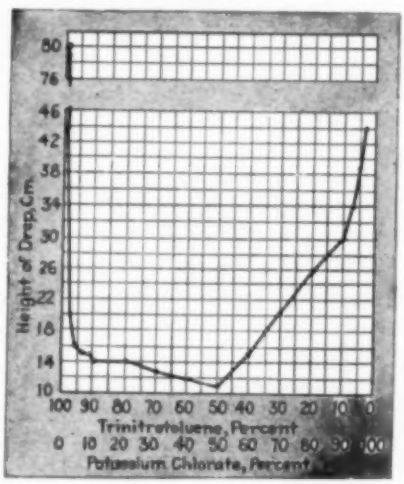
cular weight of high molecular weight carbohydrates, leads to a decreased yield of tetramethylmethylglucoside and therefore to exaggerated values of the molecular weight. It is difficult to obtain complete etherification when methylating carbohydrates by treating the substance repeatedly with metallic sodium in liquid NH_3 and CH_3I, since decomposition of the ethers formed by the metallic sodium leads to partial formation of desoxy derivatives.

Digest from "Action of Metallic Sodium on Ethers of Cellulose and Glucosides," by N. N. Shorigina, *Zhurnal Obschei Khimii* XIV, 7-8, 8.5-8.3, 1944. (Published in Russia.)

SENSITIVITY OF EXPLOSIVE MIXTURES

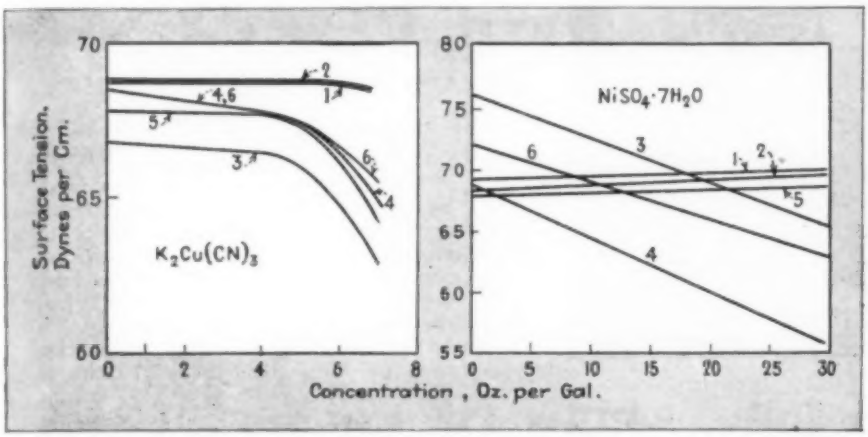
SENSITIVITY of explosives to shock is determined in practice by means of a drop hammer. This test is very sensitive to various factors such as temperature, pressure, humidity of the air, and care must be taken to work under the same conditions for comparable results. Tests were made on mixtures of trinitrotoluene with a crystallization point of 80.5 deg. C. and pure Merck potassium chlorate. The samples, 0.05 g. each, consisted of very finely divided and homogeneous mixtures, were spread out on a piece of tin foil with a surface of approximately 1 sq.cm., and dried in a desiccator for 24 hr. No sample was used more than once and the equipment was carefully cleaned after each test. The temperature was approximately 25 deg. C. Ten experiments were carried out for each percentage and the average results are shown in the attached graph. Small additions of potassium chlorate to trinitrotoluene result in greater sensitivity than small additions of trinitrotoluene to the chlorate. In the first case the decompositions begin by appearing in the incipient form. Usually they are not audible and are recognized by the presence of smoke or by careful examination of the sample. In the second case, as a rule, the decompositions caused by the shock develop suddenly, even with the accompaniment of considerable though localized noise. The most sensitive mixtures are those which contain the explosives in approximately equal parts.



Digest from "Sensitivity to Shock of Mixtures of Trinitrotoluene and Potassium Chlorate," by Alvaro Alberto and Marcello R. Liberalli, *Anais da Associacao Quimica do Brasil* III, No. 1, 37-39, 1944. (Published in Brazil.)

CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor



Six different methods for determining surface tension yield as many different results. It's variation in technique say the authors of "Surface Active Agents"

SURFACE TENSION

SURFACE ACTIVE AGENTS. *By C. B. F. Young and K. N. Coons. Chemical Publishing Co., Brooklyn.* 381 *pages.* $6.

SURFACE tension is a phenomenon involved in many processes used by the chemical process industries and their customers. Emulsification, electroplating, froth flotation and many other techniques are dependent on wetting power for successful operation. It is for chemists, operators, formulators and others in these industries that Drs. Young and Coons have prepared their book.

First of the book's two parts deals with the theory of surface tension, determination of surface tension and the structure of wetting agents. Also in part I is an alphabetical listing of wetting or emulsifying agents. It gives trade name, type or chemical composition, industrial use and manufacturer for more than 500 such agents.

Part II, introduced by a discussion of emulsions, is primarily concerned with applications. Its 12 chapters deal with problems and processes in plating, metal cleaning, pickling, cosmetic, printing ink, leather and other industries wherein detergents and wetting agents are important. Many recipes are included.

Chief merits of the book lie in the fact that considerable material has been assembled and is presented on a subject of ever-growing importance. The few typographical errors are merely disconcerting. Some aspects are over-emphasized while others are slighted. There should have been some discussion of the soap industry. On the whole, however, workers among the hydrophilic and hydrophobic groups cannot afford to overlook the possibility that the book may contain a suggestion or key to solve a perplexing problem.

HIGH POLYMER SYMPOSIUM

ADVANCING FRONTS IN CHEMISTRY. VOL. I —HIGH POLYMERS. *Edited by Sumner B. Twiss. Reinhold Publishing Corp., New York.* 196 *pages.* $4.

Reviewed by F. C. Nachod

IT SEEMS that in this brave new world of ours we never retreat but always advance, and due to this optimistic outlook the literature lately has been swamped with texts bearing titles such as "Frontiers," "Advances," "Fronts," "Advancing Fronts," and what have you which really leaves the innocent reader in a state of bewilderment.

In the Spring of 1944, Wayne University sponsored a symposium on high polymers. These lectures have now been presented to the public in book form. A list of the chapters will outline the contents of the book: Molecular structure and mechanical behavior of high polymers by H. F. Mark; Relation between structure and physical properties of high polymers by S. S. Kistler; Some applications of catalysis to hydrocarbon reactions in the synthesis of high polymers by E. C. Pitzer; Some aspects of the mechanism of addition polymerization by C. C. Price; Polymerization as a study of reactions of free radicals by F. R. Mayo; Molecular size distribution in high polymers by W. H. Stockmayer; Effect of chain length on physical properties of cellulose derivatives by E. Ott; Nature of the solid state of chain polymers by W. O. Baker; Mechanical Properties of Concentrated Solutions of high polymers by J. D. Ferry; Some concepts of textile fibers by M. Harris.

The contributions are not of equal quality nor do they strike the same tenor. Some of the papers are too general to help the worker in the field even as a review and yet not general enough to be useful to the uninitiated reader who does not know any polymer chemistry.

The best contributions, in the reviewer's opinion, are the chapters by Stockmayer, Price, Mayo, and Baker in the order mentioned.

As a bird's-eye view of the various aspects of some phases in polymer chemistry, the little text may well serve but those who turn to it as a more or less complete review of the "recent advances" in the field, will be disappointed. Also the price appears to be somewhat high for such a text.

GAS TESTING MANUAL

GAS ANALYSIS AND TESTING OF GASEOUS MATERIALS. *By V. J. Altieri. Published by American Gas Association, 420 Lexington Ave., New York 17, N. Y.* $5 *per copy to members;* $7.50 *per copy to nonmembers.*

Reviewed by Russell S. McBride

THIS is the third in a series of volumes prepared under the sponsorship of American Gas Association to establish authoritative reference books, especially for the public utility gas industries but of equal value for any chemical or process industry use. Earlier numbers in the series dealt with testing of light oils and the control of dry box purification of gas.

This particular volume on gas analysis is an admirable composite of authoritative testing methods which are widely recognized and used. It affords an outstanding aid for any laboratory which is required to make any tests or analyses of any type of industrial gas. The sponsorship was in the committee of real specialists from the industry charged by A.G.A. with revision of the now out-of-date "Gas Chemists' Handbook." The chairman of the committee describes this volume by Altieri in the foreward as follows:

"This treatise is a comprehensive book of

RECENT BOOKS RECEIVED

The Chemistry of the Carbon Compounds, Vol. III, The Aromatic Compounds. By V. von Richter, ed. by R. Anschutz, translated by A. J. Mee. Nordeman. $15.

Colloid Chemistry, Theoretical and Applied, Vol. IV. By J. Alexander. Reinhold. $20.

Kingzett's Chemical Encyclopaedia. 7th ed. Ed. by R. K. Strong. Van Nostrand. $16.

Manual for Water Plant Operators. By A. A. Hirsch. Chemical. $6.50.

Organic Reagents for Organic Analysis. Chemical. $3.75.

Physical Constants of Hydrocarbons, Vol. III, Mononuclear Aromatic Hydrocarbons. By G. Egloff. Reinhold. $15.

Quantitative Organic Microanalysis. 4th English ed. Revised and ed. by J. Grant. Blakiston. $5.

Tinplate. By W. E. Hoare & E. S. Hedges. Longmans, Green & Co. $12.

standards on gas analysis and testing of gaseous materials. Its thorough index gives a bird's-eye view of each subject, instantly enabling the reader to find essential principles, methods, specifications, tests, interpretations, and related matters. It correlates information widely scattered throughout the technical literature together with hitherto unpublished information generously contributed by contemporary workers in many scientific and technologic fields."

This book is a "must" for every gas laboratory and for every general laboratory.

LIGHT-CATALYZED REACTIONS

PHOTOSYNTHESIS AND RELATED PROCESSES. *By Eugene I. Rabinowitch. Interscience Publishers, New York. 599 pages. $8.50.*

Reviewed by J. Q. Umberger

"PHOTOSYNTHESIS and Related Processes" by Eugene I. Rabinowitch presents a wealth of very well-indexed material of interest to botanists, plant physiologists, physicists, and chemists in general on a topic whose great importance and fundamental nature stirred the imaginations of natural philosophers as far back as 1700 and which is receiving more and more attention as the fields of photochemistry, plant physiology, enzyme chemistry, etc., develop to a point where the complexities of photosynthesis begin to fall into a regular pattern.

This is the first of two volumes and contains predominantly the chemical material of photosynthesis, chemosynthesis, and related processes *in vitro* and *in vivo*. It should, as the author hopes, unite the efforts of plant physiologists with those of chemists and physicists. The second volume will discuss the spectroscopy and fluorescence of the pigments and the kinetics of photosynthesis and is expected to be published later this year.

The author's approach to the still unsolved problem of photosynthesis is the study of the effect of light on oxidation-reduction systems involving organic dyes. This is a particularly fruitful and satisfying approach. His photochemical researches and association with the Solar Energy Conversion Research Project at the Massachusetts Institute of Technology have familiarized him with many of these light-catalyzed oxidation-reductions, but he emphasizes that photosynthesis—the reversal of the combustion of carbohydrates in the green plant—is far away the most important example of this type of reaction.

$$(HCOH) + O_2 \underset{\text{light}}{\overset{\text{dark}}{\rightleftharpoons}} CO_2 + H_2O$$

In darkness the right side of the equation is favored, but in light and in the presence of chlorophyll the reaction is so strongly shifted to the left that carbohydrates (HCOH) and oxygen are given off. The organic dye (chlorophyll) probably takes part in as a light-activated oxidation-reduction enzyme.

The author has preserved a critical attitude throughout the book. The material is logically arranged and is supplemented by unusually complete table of contents, subject index, and author index. Research workers in this field will find the complete chronologically-arranged bibliography at the end of each chapter especially valuable.

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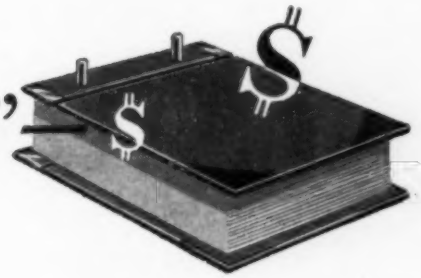

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book because of the many applications of new physical-chemical and other methods in the 20-year interim since the last treatment of photosynthesis in the well-known monograph by H. A. Spoehr of the Laboratory of Plant Physiology, Carnegie Institute of Washington. For example, by use of the heavy isotope of oxygen, O^{18}, it has been possible to show that the oxygen liberated by photosynthesis originates from water and not from carbon dioxide. Dr. Rabinowitch is to be congratulated for filling the gap with this complete, timely, and important book. We eagerly await his second, predominantly physical, volume on this subject.

THE EXAMINATION OF ZINC

POLAROGRAPHIC AND SPECTROGRAPHIC ANALYSIS OF HIGH PURITY ZINC AND ZINC ALLOYS FOR DIE CASTING. *Published by H. M. Stationery Office, 429 Oxford St., London, W. 1, 117 pages. 5s. 4d. postpaid.*

Reviewed by C. L. Luke and E. K. Jaycox

THIS book comprises four papers, one concerning the polarographic, and three the spectrographic analysis of high purity zinc and zinc base die casting alloys. They are the results of four years work by a panel of the British Standards Institution and the recommended procedures contained therein, are due to the combined efforts of the greater part of the zinc industry in Great Britain.

The paper on polarographic analysis of high purity zinc and zinc base die casting alloys describes in detail the development of methods for the determination of iron, copper, lead and cadmium in nitric acid solutions containing sodium citrate, and of copper, lead, tin and cadmium in hydrochloric acid solutions.

Some of the recommended methods described in the paper deal with the analysis of but a single element and others involve simultaneous determinations. The problem of developing simultaneous polarographic methods of analysis appears to be a difficult one and the authors are to be commended for the progress they have made; but it is evident that the methods submitted are limited in their applicability (and probably in their accuracy) and can be used only by trained personnel. It would seem that the speed of polarographic simultaneous analysis is somewhat offset by the enormous number of variables that must be controlled.

The reviewers encountered a number of ambiguous and questionable statements of minor nature. For example, the statement made at the top of p. 4 to the effect that nitric oxide interferes with the copper wave is apparently ignored in the subsequent development of the recommended method.

The three papers on the spectrographic analysis of high purity zinc and zinc base die casting alloys each treat of a different method of excitations namely: The high voltage spark, the interimittent alternating current arc and the direct current arc. The three procedures together cover, thoroughly, all the various problems that are likely to arise in the analysis of zinc alloys both from the viewpoint of the fabricator and the consumer.

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standardization of standard samples, the various aspects of the types of excitation employed, the effects of one constituent upon the analysis of another, the choice of internal control lines or lines of elements added for this purpose, the photographic techniques, plate calibration, densitometry and precision are all discussed at some length. These discussions serve as a background and a basis for understanding the final recommendations given for each procedure and leave the reader with the impression that every factor involved in the techniques has been thoroughly and well investigated. These studies are not only of value in the problem of the analysis of zinc alloys, but because of their fundamental nature, will be found useful to spectroscopists interested in the analysis of other base metals.

The authors have elected to present complete chronological accounts of their investigations. As a consequence the papers lack the clearness and conciseness usually found in technical publications. The descriptions of the numerous unsuccessful procedures which were tried may be of value to future workers in the field but their inclusion tends to obscure the positive results of the investigations. The relegation of unsuccessful or irrelevant material to an appendix would have been one solution. However, this book should certainly be included on the library shelf of every analytical laboratory engaged in polarographic or spectrochemical analyses.

RECENT BOOKS and PAMPHLETS

Bibliography on the Petroleum Industry. By E. DeGolyer and Harold Vance. Bulletin No. 83, published by School of Engineering, Agricultural and Mechanical College of Texas, College Station, Tex. 725 pages. References arranged under some 900 different subjects using a decimal system of indexing.

The Foreman and the Veteran. By Ted Handelman. Published by National Foremen's Institute, Deep River, Conn. 32 pages. 25 cents. A booklet for the foreman, the key factor in reconverting the veteran.

Code for the Prevention of Dust Explosions in the Plastics Industry. Published by National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. 22 pages. 25 cents. Detailed provisions for all common types of plastic dusts with data on relative susceptibility to dust explosions.

Potash Reserves in the United States. Prepared by Behre Dolbear & Co. for the American Potash Institute, 1155 Sixteenth St., Washington 6, D. C. 20 pages. Report on an investigation covering the potash resources of the United States.

Public Domain. Published by Scientific Development Corp., 614 West 49th St., New York 19, N. Y. 218 pages. $45 per year. Vol. I, No. 1 of a new weekly publication. Each issue will contain over 1,000 patents due to expire four weeks after date of issue and which will then be in the public domain and open to exploitation by whoever cares to use them.

Research Publications of the Polytechnic Institute of Brooklyn, 1941-1942. Published by the Institute, Livingston St., Brooklyn 2, N. Y. 103 pages. 25 cents. Vol. V, Part III. Reprints of articles by the chemical engineering staff.

Pemco Reference Manual. Published by Pemco Corp., Baltimore, Md. $5. Loose-leaf reference book of porcelain enameling.

Report of the National Academy of Sciences. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 154 pages. 30 cents. Annual report for the fiscal year 1943-1944.

Resume of the Proceedings of the Twelfth National Conference on Labor Legislation. Bulletin

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No. 76, published by Division of Labor Standards, U. S. Department of Labor, Washington 25, D. C. 40 pages. 10 cents. Recommendations adopted at the conference held last December.

A Test for Mercerization in the Presence of Dyes. By Sidney M. Edelstein, Dexter Chemical Corp., 819 Edgewater Road, New York 59, N. Y. 7 pages. Gratis. Reprint from *American Dyestuff Reporter*. Includes a brief discussion on the effect of aniline black on barium activity determinations.

Report on Behavior of Ferritic Steels at Low Temperatures. By H. W. Gillett and F. T. McGuire. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 210 pages. $4. Experimental data on the low-temperature behavior of commercial, national emergency, SAE, and similar steels.

Electronics for Engineers. By J. Markus and V. Zeluff. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. 390 pages. $6. 142 articles, reference sheets, charts and graphs reprinted from *Electronics*. Includes a brief section on electronic heating.

New Facts on Locating Regional Plants. Published by Ford, Bacon & Davis, 39 Broadway, New York 6, N. Y. 12 pages. Trends and markets in southern and western states.

California Planning. Published by State Reconstruction and Reemployment Commission, Sacramento, Calif. 65 pages. A survey based on annual reports of city and county planning commissions. Contains maps and statistical data.

Economic Poisons, 1944-1945. Publication 213, published by Bureau of Chemistry, State of California, Department of Agriculture, 1125 10th St., Sacramento 14, Calif. 101 pages. Contains bioassay of household sprays, list of economic poisons registrants, summary in table form of samples examined, including arsenicals, sulphurs, metallic compounds, fluorine compounds, botanicals, petroleum oils and some miscellaneous compounds.

Nevada Mines, Sales Opportunities, 1946. Published by Board of Supervisors of Los Angeles County. 30 pages. A comprehensive survey of Nevada mines, indexed by counties and company or name of mine. Gives location and post office address of mine; name and address of owner; list of officers of company or operators; type of ore, description of development; equipment and number of employees.

Notes on Building-Block Materials of Eastern Oregon. GMI Paper No. 14. By Norman S. Wagner. Published by Oregon Department of Geology and Mineral Industries, 702 Woodlark Bldg., Portland, Ore. 6 pages. 10 cents. A pamphlet describing deposits of suitable raw materials, tests for absorption and crushing strength of blocks, test results, equipment required and discussion of market area.

Economic Base for Power Markets in Washington. Published by Bonneville Power Administration, Portland 8, Ore. A series of booklets averaging approximately 60 pages each, covering 8 counties in Washington. Surveys made for use in appraising the prospects for electric power consumption in the Pacific Northwest. Covers the physical base, the people and their incomes, production and employment, public facilities and finance. Contains maps, graphs, photographs and appendix tables.

Wealth and Resources of Utah. Published by Utah Department of Publicity and Industrial Development, 210 Dooly Bldg., Salt Lake City 1, Utah. 47 pages. A pamphlet describing the agriculture, industries, water development and resources of Utah. Gives a short summary of oil refining, beet sugar industry, metallic ore treating facilities, light metals and miscellaneous minerals deposits, and coal and byproducts. Includes a map of distribution and trade areas and many photographs.

Ten Years of Progress, 1934-44. State of Washington. Published by Washington State Planning Council, 404 Transportation Bldg., Olympia, Wash. (Sixth and final report). 111 pages. A report of the council's survey of potentialities of land; water, including hydroelectric power markets; population; transportation; industry, including forestry and forest products, light metals, mines and minerals; agricultural research; trade and commerce.

Economic Base for Power Markets in Benton and Franklin Counties, Wash. Published by Bonneville Power Administration, Portland 8, Ore. 52 pages. A survey made for use in appraising the prospects for electric power consumption in the Pacific Northwest. Covers the physical base, the people and their incomes, production and employment, public facilities and finance. Contains maps, graphs, photographs and appendix tables.

Economic Base for Power Markets in Montana; Flathead and Lake Counties. Published

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Tentative Specifications and Tentative Standard Methods of Test for Liquefied Petroleum Gases. Bulletin TS-441. Published by California Natural Gasoline Association, 510 West Sixth Street, Los Angeles, Calif. 64 pages. $1.50 to non-members; $1.00 to members. Prepared for the use of manufacturers, marketers, and consumers who have occasion to gage, blend, sample, specify or test LPG products. Contains extensive gravity-temperature correction tables, NGAA volume correction factors, chart of corrected vapor pressures, diagrams and graphs.

Herbicidal Use of Carbon Disulfide. By H. A. Hannesson, R. N. Raynor, and A. S. Crafts. Published by University of California, Berkeley, Calif. 57 pages. A survey of the history of carbon bisulphide; studies of toxicity, movement of vapor in soils, permeability, airflow and plot studies on soils, discussion of results and practical use. Contains statistics, graphs, diagrams and photographs.

Report and Recommendations (for the year ending December 31, 1945). Published by California State Reconstruction and Reemployment Commission, Sacramento, Calif. 167 pages. Summary of California's economic outlook for 1946 with fact-finding committee recommendations.

Bibliography of Geologic Literature and Maps of Nevada. Geology and Mining Series No. 43. By Vincent P. Gianella and Robert W. Prince. Published by Nevada State Bureau of Mines and Mackay School of Mines, Reno, Nev. 205 pages. Compilation of sources of information on state's mineral resources with titles arranged according to mining districts and districts grouped according to counties. Maps are arranged by counties.

Report on Columbia River Power System. Published by U. S. Department of the Interior, Bonneville Power Administration, Portland 8, Oregon. 71 pages. Contains complete report for fiscal year 1945, including tables, photographs and auditor's report.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

Hides and Skins and Leather. U. S. Tariff Commission. War Changes in Industry Series, Report No. 13. Price 25 cents.

Aluminum. U. S. Tariff Commission. War Changes in Industry Series, Report No. 14. Price 25 cents.

Use of Training Aids in the Armed Services. U. S. Office of Education Bulletin 1945, No. 9. Price 10 cents.

Synthetic Organic Chemicals. United States Production and Sales, 1941-43. U. S. Tariff Commission. Report No. 153, Second Series. Price 30 cents.

Prevention of Explosives Accidents in Metal Mines. Metal-Mine Accident-Prevention Course—Section 4. Bureau of Mines, Miners' Circular 54. Price 20 cents.

Chlorination of Magnesia. By H. A. Doerner and W. F. Holbrook. Bureau of Mines, Report of Investigations R. I. 3833. Mimeographed.

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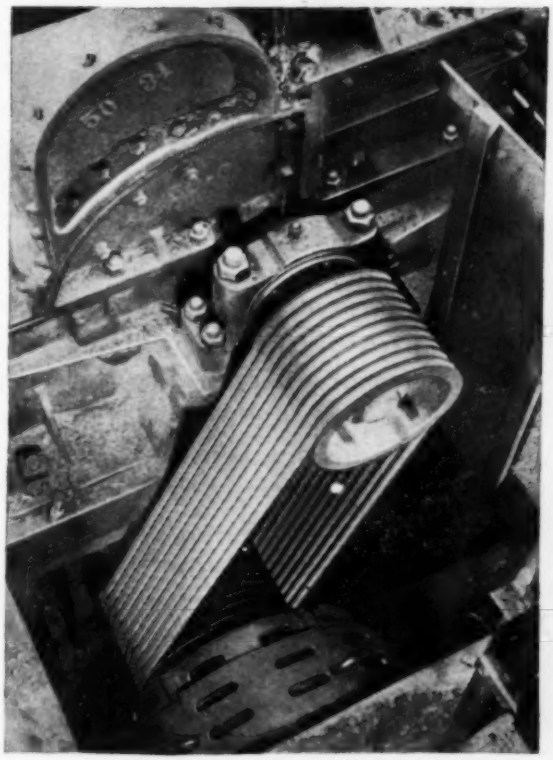

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PORTLAND 9, ORE., 333 N.W. 5th Ave. DALLAS 2, TEXAS, 1710 N. Market St. SAN FRANCISCO 3, CAL., 170 Ninth St.

By I. L. Feld, G. D. Coe, and Will H. Coghill. Bureau of Mines, Report of Investigations R. I. 3838. Mimeographed.

Manufacture of Sponge Iron in Periodic Brick Kilns. By Kenneth M. Smith and S. E. Burton. Bureau of Mines, Report of Investigations R. I. 3841. Mimeographed.

Suggested Methods for Installing Dust-Allaying Equipment in Bituminous-Coal Mines. By C. W. Owings. Bureau of Mines, Report of Investigations R. I. 3843. Mimeographed.

Performance of a Hydraulic Classifier Designed to Incorporate Four Hitherto Neglected Principles. By Will H. Coghill, G. D. Coe, and I. L. Feld. Bureau of Mines, Report of Investigations R. I. 3844. Mimeographed.

Mineral Resources Summaries. Final monthly or quarterly reports on various metals and minerals for which such statistical statements are issued by U. S. Bureau of Mines have been prepared to include annual figures for the calendar year 1945. Those requiring such statistics may now be supplied by the bureau on request.

Scheelite Deposits in the Northern Part of the Sierra de Juarez, Northern Territory, Lower California, Mexico. By Carl Fries, Jr. and Eduardo Schmitter. Geological Survey, Bulletin 946-C. Price 25 cents.

The Data of Geochemistry. 5th Edition. By F. W. Clarke. Geological Survey, Bulletin 770. This important volume is again available, in the 5th edition, reprinted without changes. Price $1.25.

Heat Contents above 25°C. of Seven Manganese-Copper Alloys. By B. F. Naylor. Bureau of Mines, Report of Investigations R. I. 3835. Mimeographed.

Missouri Valley Maps. Series of four reports with maps have been prepared showing mineral resources of Missouri River Valley. These are available singly at 40 cents each, or in a set $1.50 for four, covering: Part I. Metallic mineral resources. Part II. Nonmetallic mineral resources. Part III. Fuel resources. Part IV. Construction materials. Orders and remittances should be addressed to Director, U. S. Geological Survey, Washington 25, D. C.

List of Available Publications of the U. S. Department of Agriculture. Revised to January 1945. Department of Agriculture Miscellaneous Publication No. 60. Printed.

Changes in Lemons During Storage as Affected by Air Circulation and Ventilation. By E. M. Harvey. Department of Agriculture Technical Bulletin No. 908. Price 10 cents.

Surplus Property Reports. Surplus Property Administration has made interim reports to Congress on various important groups of plants or commodities. Now available at Superintendent of Documents are the following, which report descriptions of existing facilities, as well as summaries of surplus property disposal policy: Aircraft and Aircraft Parts, 10 cents. Aircraft Plants and Facilities, 15 cents. Aluminum Plants and Facilities, 25 cents. Aviation-Gasoline Plants and Facilities, 15 cents. Chemical Plants and Facilities, 20 cents. Supplement III. Progress in Disposal of Synthetic Ammonia and Alcohol Plants (for insertion in Chemical Plants and Facilities Report), 5 cents. Disposal of Government Iron and Steel Plants and Facilities, 15 cents. Magnesium Plants and Facilities, 15 cents. Patents, Processes, Techniques, and Inventions, 10 cents. Government Owned Pipe Lines, 20 cents. Radio and Electrical Equipment, 10 cents. Shipyards and Facilities, 10 cents. Synthetic Rubber Plants and Facilities, 10 cents. Transportation Facilities, 10 cents.

Statistical Abstract of the United States 1944-45. Bureau of the Census. Price $1.75 (buckram).

Statistics of Natural Gas Companies 1944. Federal Power Commission, FPC S-44. For sale only by Federal Power Commission, Washington 25, D. C. Price $1.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog have been issued on the following items: Soap; Grit, Hand, Cake P-S-576a. Paint; Primer-Sealer, (for) Plaster and Wallboard TT-P-56a. Gaskets; Rubber (natural or synthetic), Molded, Sheet, and Strip HH-G-156b. Packing; Diaphragm HH-P-61d. Ink, Stencil; Opaque, for marking Non-Porous Surfaces (Metal, Glass, etc.) TT-I-558. Ink, Stencil; Opaque, for Marking Porous Surfaces (Wooden-Boxes, Fiber-Cartons, etc.) TT-I-559. Valves, Bronze; Angle, Check, and Globe, 125- and 150 Pound, Screwed and Flanged (for Land Use) WW-V-51a. Valves, Bronze, Gate; 125- and 150-Pound, Screwed and Flanged (for Land Use) WW-V-54. Amendment-2. Floor-Covering; Rubber, Sheet ZZ-F-461. Amendment-1. Valves; Rubber ZZ-V-51a. Price 5 cents each.

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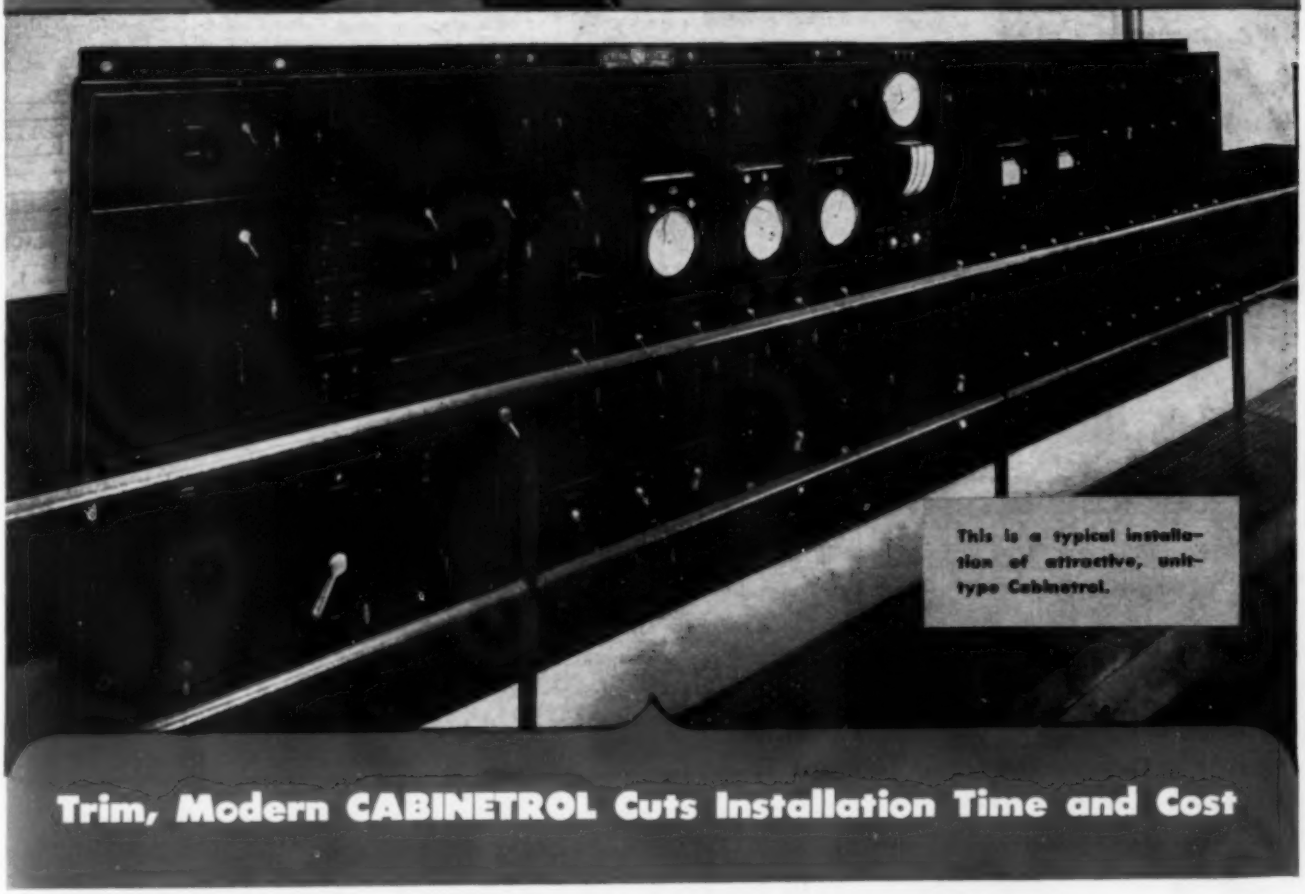

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Advertising. Magazines, Inc., Chicago, Ill.—6-page advertising brochure designed to assist in solving the problems incident to building a catalog, getting out flyers, or carrying on a publicity campaign. It is entitled "Your Catalog and Publicity Problems."

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Automatic Clutch. Hardinge Co., Inc., York, Pa.—Bulletin No. 45. 8-page booklet illustrating and describing the Type BLM clutch for use in various types of drives.

3

Boilers. John Nooter Boiler Works Co., St. Louis, Mo.—Two leaflets featuring the facilities and services offered by this company in the manufacture of boilers and other process equipment. Includes data on this company's metallizing service, and also features the corrosion resistance equipment manufactured by this company.

4

Case Hardening. American Cyanamid & Chemical Corp., New York, N. Y.—4 data sheets each describing one of the following chemicals: Aero Brand Nitriding Salt, Aerocarb C, Aeroheat 1400, and Aerocarb Deep Case 40.

5

Conveyors. Speedways Conveyors, Inc., Buffalo, N. Y.—2-page leaflet featuring the Speed-Lift belt conveyor, which is adjustable, reversible, and portable. Specifications, sizes and capacities are included.

6

Crushers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 7B6006C features the Type R reduction crusher. Various features of this crusher are illustrated. Bulletin 7B6369 describes the A-1 jaw crusher used for tough, abrasive, high compressive strength materials. Capacities and sizes are given.

7

Diesel Engines. Cooper-Bessemer Corp., Mount Vernon, Ohio—8-page folder featuring the Type FW-supercharged locomotive diesel engine available from this company.

8

Dryers. J. O. Ross Engineering Corp., New York, N. Y.—2-page leaflet featuring the ovens and dryers manufactured by this company.

9

Electrical Equipment. Cook Electric Co., Chicago, Ill.—20-page booklet covering this company's line of electrical relays.

10

Electro-Coating. MacDermid, Inc., Waterbury, Conn. A data sheet is now available describing the electro-cleaning of copper-coated articles with Anodex 61-X. Included are typical cleaning cycles for use with any copper-coated article.

11

Equipment. Gardner-Denver Co., Quincy, Ill.—Illustrated brochure giving the history, organization and facilities of this company. Shows application pictures of the various products made by this company.

12

Equipment Lining. Industrial Lining Engineers, Inc., Edgewood, Pa.—4-page leaflet featuring the facilities and services offered by this company.

13

Evaporators. Swenson Evaporator Co., Harvey, Ill.—52-page booket entitled "Heat Transfer and

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Crystallization," a newly revised edition of a previous publication, edited by Dr. W. L. Badger, consulting engineer, and G. E. Seavoy, manager of this company. Includes chapters on basic principles of heat transfer, evaporator types, heat transfer coefficients in evaporators, steam economy of evaporaotrs, theory and practice of crystallization. This is a high calibre engineering handbook and contains a wealth of valuable information for the evaporator engineer.

14

Fatty Acids. Emery Industries, Inc., Cincinnati, Ohio.—Four loose-leaf pages for insertion in this company's loose-leaf data book, giving data on stearic-palmitic acid mixes. Includes information on the storage and handling of fatty acids and gives equipment and materials of construction for use in handling these materials. This table includes data on storage tanks, heating coils, piping, valves, pumps, heat exchangers, processing vessels and shipping containers. One of these data sheets is devoted to the chemistry and applications of certain plasticizers, such as Azelaic acid.

15

Filters. Filtration Engineers, Inc., Newark, N. J.—16-page illustrated bulletin featuring this company's rotary vacuum filters for various industries including chemicals, foods, ceramics, metallurgy, pulp and paper, sewage, etc. The principles of operation of the FE String Discharge Rotary Vacuum Filter are discussed and illustrated. Construction details are given and a section is devoted to materials of construction, motor drives, filter cloth, and the FE automatic valve.

16

Filters. Niagara Filter Corp., Buffalo, N. Y.—Bulletin A-246. Booklet describing Niagara filter systems for a wide variety of applications in a number of different process industries.

17

Fire Extinguishers. Walter Kidde & Co., Inc., Belleville, N. J.—12-page booklet illustrating and describing the inspection and maintenance of fire extinguishers. Covers in detail the maintenance system required for this work. The different kinds of extinguishers used, their inspection, refilling and maintenance are included.

18

Flame Cutting. Victor Equipment Co., San Francisco, Calif.—4-page illustrated folder featuring the portable flame-cutting outfits which can be carried and operated by one man.

19

Gas Alarm System. Davis Emergency Equipment Co., Inc., Newark, N. J.—Technical Bulletin No. 1116 E describes a method for detecting and giving audible notification of hazardous gas or vapor conditions sometimes present during industrial processing operations. This 8-page bulletin describes the various combinations possible and illustrates the different parts of the equipment. Operating principles, together with installation diagrams, are included.

20

Gas Atmospheres. Surface Combustion Corp., Toledo, Ohio.—12-page bulletin, No. SC-129, features the preparation and use of gas atmospheres for heat-treating purposes. The development and use of gas atmospheres in heat-treating is covered in detail, and the preparation of these atmospheres, using different gases is discussed. Equipment for preparing these gases is illustrated with pictures as well as cross-sectional diagrams showing operating principles. A table showing the composition of gases, applications, capacities of units and costs for different gas atmospheres is included.

21

Heat Exchangers. Griscom-Russell Co., New York, N. Y.—Bulletin 1614. 16-page catalog illustrating and describing the twin G-Fin element used in heat transfer equipment. The outstanding features of this equipment are listed in tabular form with corresponding advantages. Construction details, including specifications, sizes, dimensions, for the different types of elements, are illustrated and listed.

22

Laminating Resins. Reichhold Chemicals, Inc., Detroit, Mich.—Booklet entitled Pliophen Phenolic Resins for Bonding and Laminating. Contains formulas and complete descriptions of all this company's Pliophen resins.

23

Lead Equipment. O. G. Kelley & Co., Boston, Mass.—44-page booklet featuring the use of lead in chemical and processing plants. Applications of lead for various purposes are illustrated and described, and the important properties and uses of different kinds of lead are given. The dif-

ferent types of lead fittings and pipe are included and the different weights and wall thicknesses for different sized lead pipe are given. A section is devoted to the recommended materials of construction for some 44 different chemicals.

24

Leather Belting. E. F. Houghton & Co., Philadelphia, Pa.—Large-size wall chart covering all phases of "Care of Leather Belting." Includes detailed information on installation, operation, maintenance, etc. Covers such details as cutting leather belts, preparing surfaces, cementing, lacing. Includes engineering information on how to calculate belt speeds, belt sizes, pulley ratios, etc.

25

Liquid Level Sight Gages. Jerguson Gage & Valve Co., 87 Fellsway, Somerville 45, Mass. 4-page leaflet illustrating the various types of liquid-level gages and specialties manufactured by this company. Specifications, sizes, and list prices are included.

26

Lubrication. Gulf Oil Corp., Pittsburgh, Pa.—20-page booklet featuring the manufacture of lubricating oil for steam turbines. Includes a pictorial description of the Gulf Alchlor process for refining lubricating oils.

27

Magnetic Drives. Electric Machinery & Mfg. Co., Minneapolis, Minn.—16-page illustrated booklet describing the magnetic adjustable-speed drives for boiler draft fans, centrifugal blowers and compressors, and other applications. Principles of operation, performance characteristics, and applications are described.

28

Materials Handling. Jeffrey Mfg. Co., Columbus, Ohio—Catalog 791. 32-page catalog illustrating and describing the materials handling and process equipment manufactured by this company. Includes information on vibrating feeders, weigh feeders, rotary bins, check valves, bin level indicators, mechanical feeders, reduction machinery, screens, magnetic separators, elevating machinery, conveyors, and other equipment. Also 6-page folder featuring the Bin Eye Indicator for positive accurate control of bin level.

29

Materials Handling. Robins Conveyors, Inc., Division of Hewitt Rubber Corp., Passaic, N. J. —Bulletin 128. 8-page booklet featuring the Robins Car Shakeout for rapidly emptying hopper bottom railroad cars. The principle of operation is described and illustrated pictorially. Operations of the various applications of the Robins Car Shakeout are described for the discharge of different types of material.

30

Mercerizing. Dexter Chemical Corp., New York, N. Y.—Booklet containing two reprints entitled "A Test for Mercerization," and "The Effect of Aniline Black on Barium Activity Determinations." Also a 12-page booklet featuring the use of Dyphenol in mercerizing operations.

31

Metal Fabrication. Hungerford Corp., Big Flats, N. Y.—16-page pictorial booklet describing the metal fabrication services and facilities available from this company.

32

Metallurgy. Sam Tour & Co., Inc., New York, N. Y.—2-page leaflet describing the facilities and services of this company.

33

Packing. Graton & Knight Co., Worcester, Mass.—336-page book describing the selection of mechanical packing packs, their application, and the design of adjacent parts in hydraulic or pneumatic equipment. Basic principles which influence packing life and machine performance are outlined. Includes data on both leather and synthetic rubber packings, as well as illustrations and photographs of various packing designs, and applications. Nearly fifty reference tables are included to save time-consuming calculations. Price, $4.50.

34

Paint. Peninsular Chemical Products Co., Van Dyke, Mich.—4-page leaflet describing "Pen-Kote 500 Maintenance Paint" manufactured by this company. Outstanding properties of this paint, together with instructions for applications, are included.

35

Paper Bags. Bemis Bros. Bag Co., 408 Hines

St., St. Louis 2, Mo.—8-page booklet describing the proper method used in caring for paper bags in storage and how to protect paper bags from deterioration.

36

Plastics. Bakelite Corp., 300 Madison Ave., New York 17, N. Y.—19-page illustrated booklet describing and illustrating Vinylite Plastic Elastomeric compounds. Includes data on molding and extrusion compounds, flexible sheathing and film, cloth coating compounds, and other valuable information.

37

Plastic Specialties. The Emeloid Co., 286 Laurel Ave., Arlington, N. J.—24-page catalog featuring the plastic advertising specialties manufactured by this company.

38

Petroleum Process. Chemical Construction Corp., Empire State Building, 450 Fifth Ave., New York 1, N. Y.—Bulletin S-107. 6-page leaflet describing the Chemico alkylation acid regeneration process. Details of this process are shown in diagram form and each unit of the process is discussed.

39

Porcelain Enamel. Farrel Enamel Corp., 4150 E. 56th St., Cleveland 5, Ohio—Booklet entitled "Guide and Reference for Color in Porcelain Enamel" which features the oxides and colors manufactured by this company for use in tinting porcelain enamels and plastics. A color chart is also available from this company which illustrates the basic oxides and some of the blends that can be made from base colors.

40

Pressure Control. Meletron Corp., 950 N. Highland Ave., Los Angeles, 38, Calif.—8-page booklet featuring pressure-operated switches which operate from 30 in. of Hg. vacuum to 5,000 lb. per sq. in. pressure for use in gas, steam, oxygen or oil systems.

41

Process Equipment. The Youngstown Welding and Engineering Co., 3700 Oakwood Ave., Youngstown 9, Ohio—16-page brochure illustrating and describing the various types of process equipment, tubing, fittings, etc., made by this company.

42

Product Testing. Pittsburgh Testing Laboratory, Pittsburgh, Pa.—30-page brochure illustrating and describing in detail the services and facilities offered by this company in its district branches and laboratories throughout the U. S., Canada and England. These services include testing of materials, field inspection and testing and product performance testing in many industrial fields.

43

Pulverizers. Prater Pulverizer Co., 1825 So. 55th Ave., Chicago 50, Ill. 16-page booklet featuring the dual-screen pulverizer for use in the process industries. Principles of operation are illustrated and discussed, and the application of this piece of equipment to various industries is covered.

44

Pumps. The ECO Engineering Co., 12 New York Ave., Newark 1, N. J.—2-page illustrated instruction sheet describing the installation and operation of ECO gearless pumps used for circulating water and oil. Pump dimensions, capacity checks and prices are included.

45

Pumps. Ingersoll-Rand Co., Phillipsburg, N. J.—Bulletin 7057. 20-page illustrated catalog covering the design, construction, and engineering details of the Cameron single-stage general service pumps manufactured by this company. Applications and installations are illustrated and some typical pumping problems are described.

46

Pumps. Taber Pump Co., 288 Elm St., Buffalo 3, N. Y.—Bulletin No. S-146. 8-page illustrated brochure discussing the use of various types of pumps in different applications. Discusses basic principles of pump selection.

47

Regulating Valves. Strong, Carlisle and Hammond Co., 392 W. 3rd St., Cleveland, 13, Ohio—Catalog 155. 12-page illustrated catalog featuring pressure regulating valves for steam, air and gas, furnished by this company. Types, sizes and capacities, together with list prices are given.

GUARDITE

EVAPORATIVE COOLERS

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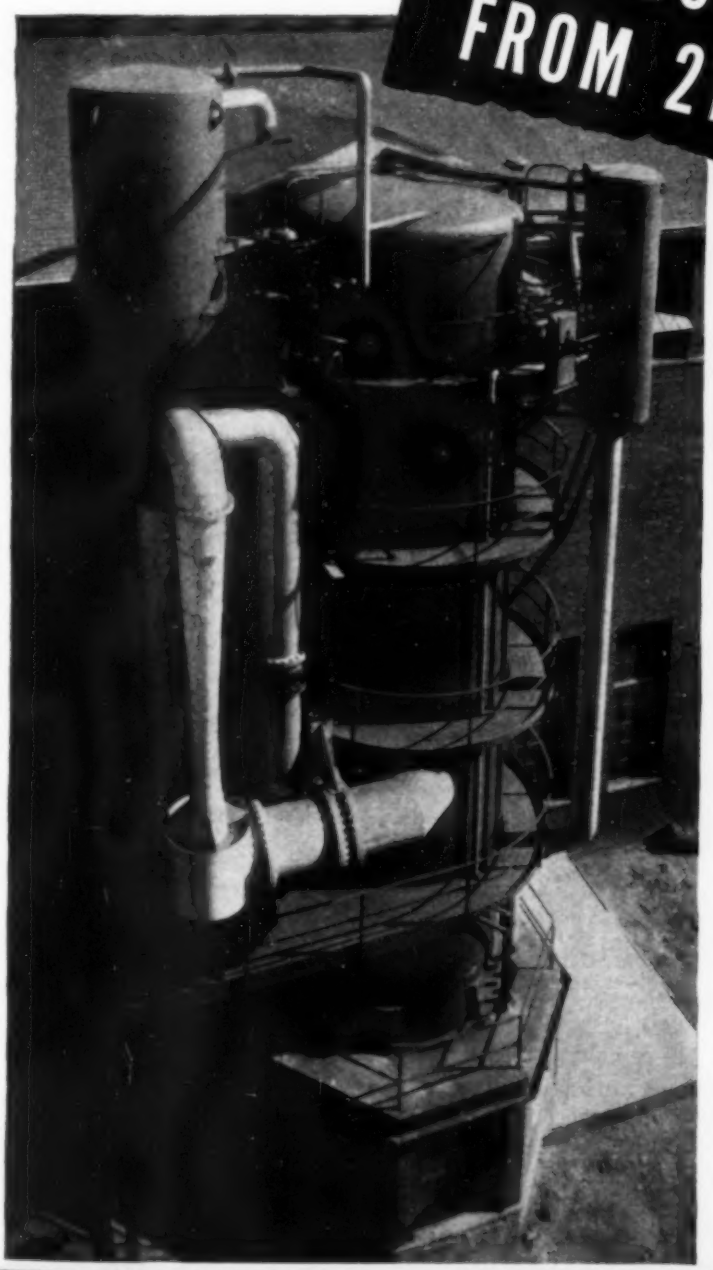

These coolers are designed for either continuous or batch operation. The cooler shown at left is designed to continuously cool 376,000# distillery mash and slops per hour from 190° to 75° F. The completely automatic controls system eliminates the necessity for an operator. There are no moving parts to wear. These units can be furnished in sizes to meet your requirements and fabricated of the proper materials to meet your conditions. When writing please state kind and quantity of material to be cooled, amount and temperature of cooling water available, steam available, and pressure.

We will be pleased to give complete information as to operation and costs.

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Vacuum Process Engineers

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Details of operation are illustrated and discussed. Comprehensive capacity tables are given and accessory equipment such as strainers, separators and traps are described.

48

Resins. Hercules Powder Co., Wilmington, Del.—8-page booklet describing Polypale resin, a polymerized rosin which is used in the paint and varnish industry. Physical and chemical properties are given, color, grades and applications are described.

49

Resins. Synvar Corp., Wilmington, Del.—New instruction pamphlet covering uses of a series of resorcinol-type resins manufactured by this company. Includes data on many applications for the Synvaren PLS resins and includes data on their properties.

50

Relief Valves. Farris Engineering Co., Palisades Park, N. J.—Catalog No. 45. Catalog featuring safety and relief valves manufactured by this company. A catalog supplement, No. 45 A, gives prices for this equipment.

51

Scales. O. K. Scale Co., 1389 Niagara St., Buffalo 13, N. Y.—Bulletin No. 38. Two-page leaflet featuring the O. K. bagging scale for filling and weighing materials in burlap, cloth or paper sacks.

52

Slime Prevention. Wallace and Tiernan Products, Inc., Belleville 9, N. J.—4-page leaflet featuring the use of chlorination for the removal and prevention of slime fouling on waterside surfaces.

53

Stainless Steel. Allegheny Ludlum Steel Corp., Brackenridge, Pa.—100-page handbook of stainless steel containing data on types of stainless and corrosion resistance against various materials. Discusses properties, products, available forms and sizes and fabrication methods. Contains general tables of bar weights, weights of sheets, weights of tubes, etc.

54

Stainless Steel. Lebanon Steel Foundry, Lebanon, Pa. 4-page leaflet featuring the straight chromium stainless steels made by this company. Includes data on the five grades of stainless made by this company. Contains a list of materials which do not corrode these steels.

55

Storage Batteries. Gould Storage Battery Corp., Depew, N. Y.—Catalog 100. Illustrated catalog featuring the storage batteries manufactured by this company for industrial truck and tractor service. Included are discussions on the theory of lead-acid storage batteries and the care and maintenance of batteries.

56

Synthetic Rubber. Raybestos-Manhattan, Inc., Passaic, N. J.—Bulletin No. 6885. New folder illustrates and describes Flexlastics which are compounds of natural and synthetic rubbers combined with age-resisting chemicals, pigments, fillers, etc., to produce a balance, coordinated and homogeneous material.

57

Turbine Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin RP-277. 4-page illustrated reprint entitled "Influence of Groundwater Level on Turbine Well Pump Performance."

58

Visual Study Curve. American Optical Co., Southbridge, Mass.—A brochure entitled "Industrial Visual Efficiency, A Management Opportunity" describes a vision testing program developed and designed to promote industrial efficiency by testing employees who need eye examinations and correction.

59

Welding. Handy & Harman, New York, N. Y.—4-page leaflet featuring the use of this company's low-temperature brazing alloys.

60

Wood Tanks. O. G. Kelley & Co., Boston, Mass.—16-page booklet illustrating and describing the various types of wood tanks manufactured by this company. A wide variety of applications are illustrated. Tables of dimensions, capacities and weight of the various types of tanks are given.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

INDUSTRIAL CONSUMPTION OF CHEMICALS IN FIRST QUARTER HIGHER THAN A YEAR AGO

PRODUCTION of chemicals has been gaining ground and is rapidly returning to the highest levels reached in wartime. As measured by the index of the Federal Reserve Board, the output in first quarter of this year was somewhat less than 3 percent below that for the comparable period of last year and less than 5 percent under that of the second quarter of 1945, which formed the record period. With the closing of some government plants and the drop in demand for chemicals for the manufacture of ammunition, there has been a change in the relative activity of some of the more important chemicals with several now being turned out in reduced volume. It is obvious that marked increases in outputs in other materials are necessary to keep the over-all total on a rising line. The progress in industrial chemical production is shown in the index number for last December which is revised to 378 and which moved up to 386 in January and to a preliminary figure of 389 in February.

Consumption of chemicals likewise is moving forward with the *Chem. & Met.* index for January sharply revised to 192.92 which is an all time high for industrial consumption. The unadjusted index for February fell to 175.22 due to the reduction in the number of working days and the precipitous drop in activities in the steel and coke industries. In some cases daily rates of operation were higher in February as shown by the fact that superphosphate production fell but little below the January figure and woodpulp output also compared favorably with that for the preceding month.

A study of the individual consuming industries shows that only a few of them are holding at or near their highest points. Fertilizers, rayon, and plastics have contributed more than their share to the rise in the index numbers and rubber production which should hold about the same as last year is more important because of the larger percentage which is moving into civilian use. A large part of packaging requirements still rests upon glass and this is reflected in the high outturn of glass containers. Flat glass is becoming increasingly important and as the building and automotive programs gather headway, requirements for plate glass should be larger than at any previous time in the history of the industry. Plate glass production in February amounted to 13,849,000 sq. ft. which is the largest monthly total since November 1941.

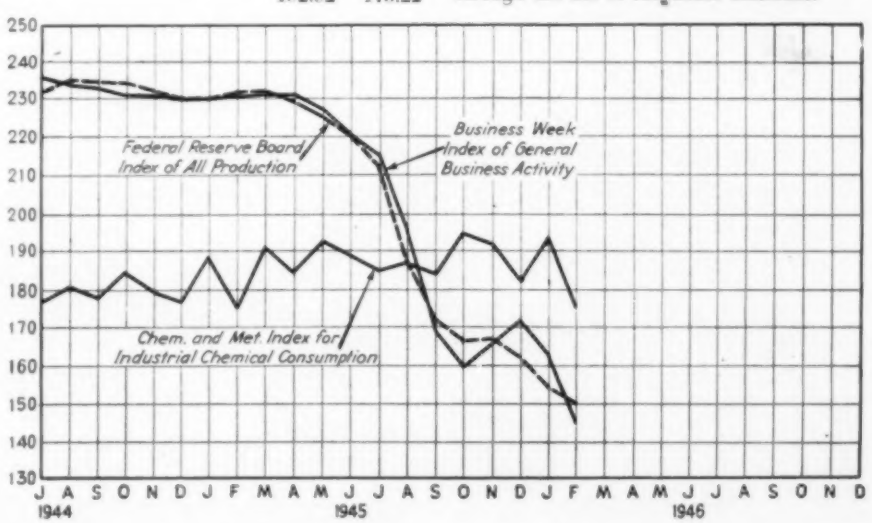
Work stoppages have directly affected outputs of such products as steel and some of the coal-tar chemicals, notably sulphate of ammonia, so that the possibility of new production records this year has been eliminated. But in other important industries, with the exception of petroleum refining and textiles, conditions from a demand standpoint warrant new highs for output although in the case of textiles, it is the curtailment of demand on the part of manufactures and not of consumers which is the deterring factor. These premises lead to the conclusion that the *Chem. & Met.* index for consumption of chemicals will advance considerably above its present figure. Had normal conditions prevailed in January in the steel and coke industries the index for that month would have crossed 200. Estimates have been made that chemical production this year will double that of 1939. As the *Chem. & Met.* index for 1939 stood at 124.15, it is possible that consumption of chemicals at some period during the year will come close to doubling the 1939 rate of operation. Rayon production for the quarter was at a rate much more than double the 1939 figure.

Export demand for chemicals has been active and outward shipments will increase as stocks become more plentiful. Such shipments naturally will take up a part of production but domestic consumption has been aided by making surplus government chemicals available for industry. For instance the large stocks of phosphorus on hand at the close of the war were turned over to chemical manufacturers. Early this month it was announced that more than 180,000 tons of excess sulphuric acid stocks in the form of oleum and spent acid have been declared surplus by the Army Ordnance Department since V-J Day. Almost 60 percent of the spent acid coming from TNT manufacture was sold to private industry before July 1, 1944. Since the war the Ordnance Department has processed the left-over stocks of oleum to salable strength and purity for disposal through the War Assets Corp.

Soap makers have worked so far this year under the restrictions which were in effect in the latter part of last year. Some indications of improvement are noted in reports that shipments of copra from the Philippines are gaining in volume with still larger shipments in prospect for the latter part of the year. Paint makers have found no relief in the tight situation surrounding pigments and drying oils. The quota for lead pigments for the second quarter has been cut to 38½ percent of that used in the first half of 1944. This represents a cut from 48 percent allotted for the first quarter. While the output of titanium pigments has held up well and is expected to be expanded, the amounts made available for civilian use are not sufficient for all requirements and attempts are being made to have the Navy cut down its consumption through the use of substitute materials.

***Chem. & Met.* Index for Industrial Consumption of Chemicals 1935=100**

	Jan. revised	Feb.
Fertilizers	45.11	44.05
Pulp and paper	20.55	19.73
Petroleum refining	18.50	16.86
Glass	21.60	20.58
Paint and varnish	18.41	17.80
Iron and Steel	7.58	2.02
Rayon	20.62	18.74
Textiles	11.04	10.25
Coal products	6.47	2.30
Leather	4.65	4.60
Industrial explosives	5.24	5.29
Rubber	6.90	6.85
Plastics	6.25	6.15
	192.92	175.22



CONTINUED WORLD SCARCITY OF NITROGEN FORECAST

OFFICIAL compilations of the world nitrogen situation have not been available in recent years but estimates for requirements and production as far ahead as the 1947-48 season were published last month in *The Financial Times* of London. There is no information about Russian requirements or production, hence that country is not included in the compilation. Data for the other countries were prepared by what is described as "a well-known nitrogen expert."

The article points out that prior to the war, the International Nitrogen Cartel was in operation to control the excessive world capacity while now there is a worldwide shortage which will continue through the 1947-48 season. Commenting on the position of the industry in the separate geographical divisions, the article states that United States capacity at the end of the war had reached 1,250,000 tons but since then six plants have been closed. Thus annual production is now only about 735,000 tons with another 210,000 tons in Canada.

In Germany, current production is estimated at 200,000 tons which will be increased next year if the coal supply improves. Shortage of coal also limits production in Italy and has diverted hydroelectric power for other uses. In Japan output has been reduced to an annual rate of 100,000 tons as a result of war damage. Plants for 100,000 tons are under discussion in India.

Estimates of World Requirements and Production of Nitrogen

1,000 tons of nitrogen

	1945–46			1946–47			1947–48		
	Requirements	Production	Distribution[1]	Requirements	Production	Distribution[1]	Requirements	Production	Distribution[1]
United States and Canada	1,015	945	900	1,015	1,000	965	1,015	1,050	985
British Empire	350	310	315	375	310	340	400	310	380
Central and South America	40	270	35	40	320	40	45	340	45
Europe and Egypt, excluding Germany, Poland, Czechoslovakia	725	340	615	950	470	730	1,000	550	840
Germany, Poland, Czechoslovakia	400	200	200	500	400	400	500	500	500
Far East, excluding Japan	100	50	50	120	100	100	175	150	150
Japan	400	100	100	400	100	100	400	100	100
Total	3,030	2,215	2,215	3,400	2,700	2,700	3,535	3,000	3,000
Deduct for industrial use	365	365	365	365	365	365	365	365	365
Agricultural nitrogen	2,665	1,850	1,850	3,035	2,335	2,335	3,170	2,635	2,635

[1]Includes 275 tons industrial nitrogen for the United States and Canada; 65 tons for the British Empire; 25 tons for Europe and Egypt.

NEVILLE

Nevillac OA Plasticizer

Specifications and Properties

Sp. Gr. @ 30° 15.6°C.	0.980 to 1.00
Viscosity (Gardner-Holdt)	W (average) @ 25°C
Distillation by volume	Essentially between 300°C and 375°C
Max. % off @ 300°C.	5%
Refractive Index @ 20°C.	1.5355
Molecular Weight	230
Odor	Sweet, Characteristic
Color	Amber
Color Retention	Good

Fields of Use

Adhesives of the waterproof, optical, shoe, packaging and pressure sensitive types;

Paper coatings both waterproof and greaseproof and for ordnance wrap;

Paints and varnishes including laminating varnishes, printing and duplicating inks;

Artificial leather and leather finishes;

Raincoats;

As a plasticizer for ethyl cellulose in lacquers, plastics and stripping compounds.

THIS new plasticizer is an alkylated phenol and has a wide range of solubilities and compatibilities. It is soluble in almost all liquids except water and glycerol. It is compatible with most synthetic resins including cellulose esters and ethers (nitrocellulose, ethylcellulose, cellulose acetate, etc.), vinyl acetate, vinyl butyral, zein, nylon, and partly compatible with vinyl acetate and chloride copolymer.

Being an alkylated phenol, Nevillac OA undergoes typical reactions. For instance, with formaldehyde, oil-soluble phenolic resins are produced which can be formulated as such in varnishes, or can be used in fortifying rosin, rosin esters, alkyd resins and established types of phenolic resins.

Write for gratis sample and further information on Nevillac OA for your particular application.

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PITTSBURGH, 25, PA.

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BENZOL • TOLUOL • XYLOL • TOLLAC • NEVSOL • CRUDE COAL TAR SOLVENTS
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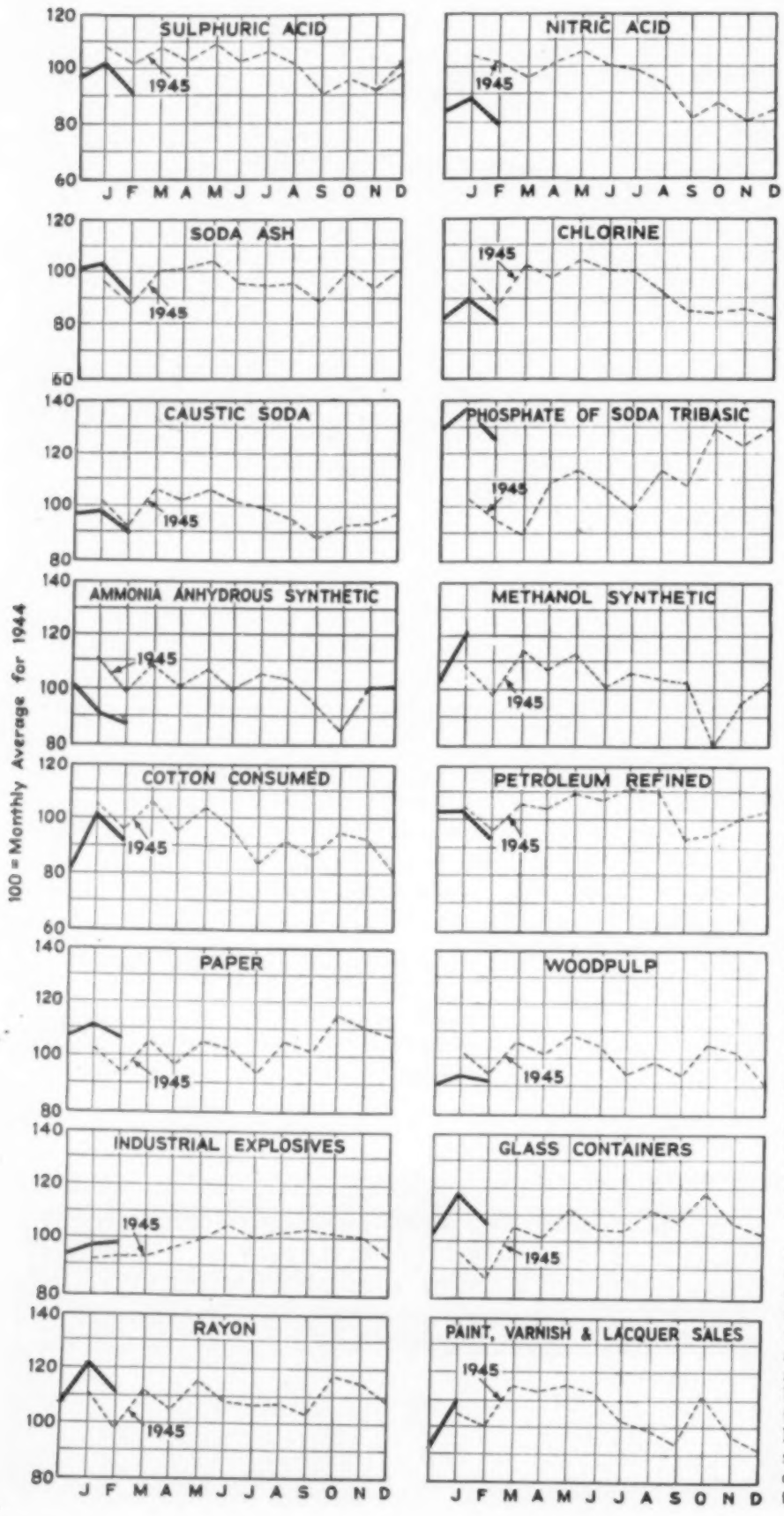
RUBBER COMPOUNDING MATERIALS • WIRE ENAMEL THINNERS • DIBUTYL PHTHALATE
RECLAIMING, PLASTICIZING, NEUTRAL CREOSOTE, AND SHINGLE STAIN OILS

A-21

PRODUCTION AND CONSUMPTION TRENDS



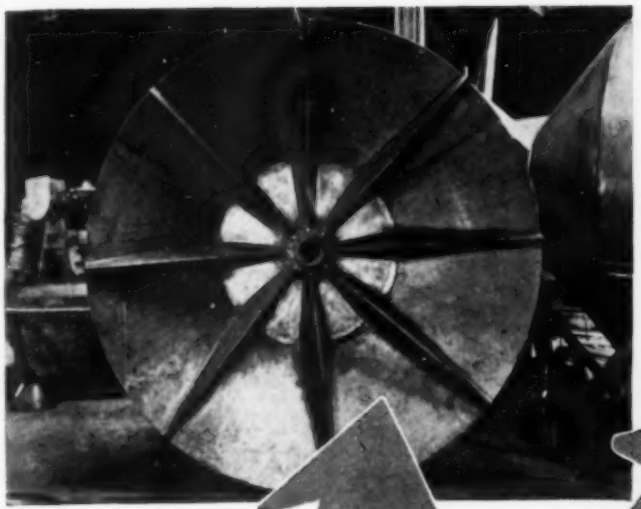
BASED ON activities carried out in the first quarter of the year, the manufacture and distribution of chemicals is moving ahead and is approaching the highest tonnages ever recorded by the industry. Based on expansion plans already announced future capacities will be considerably higher than those now installed. General production, in the face of adverse conditions, continued to decline during the quarter but the only effect on chemicals was to restrict the rate of growth. Seasonal influences were at work during the quarter as was seen in larger outputs of agricultural chemicals such as calcium arsenate, lead arsenate, ammonium nitrate, and superphosphate. Production of copper sulphate, for which there is a record demand, was held in check by labor troubles at important producing plants.

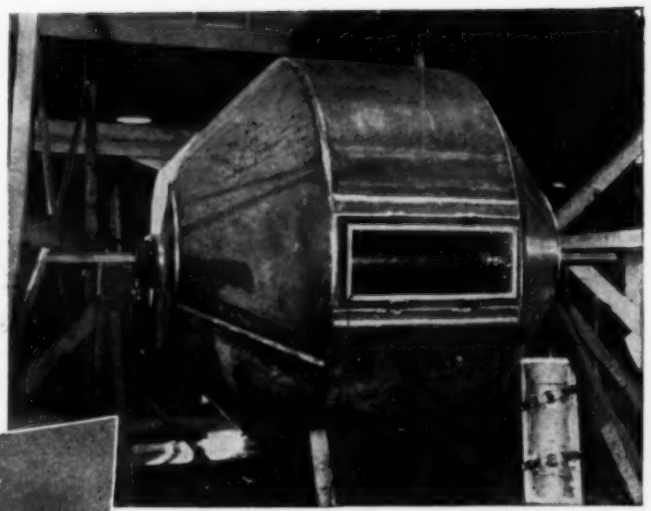
The position of chlorine has brought out considerable discussion because all of available capacity is not now being utilized and stocks of chlorine and its derivatives are large enough to subject some of them to selling pressure. However there is good reason to believe that before long chlorine requirements will increase materially and that larger production schedules will be put into effect.

Some of the important basic chemicals such as soda ash and caustic soda have been turned out in smaller volume in recent months yet there is a scarcity of both these products. Delivery of soda ash to domestic consumers has been delayed and numerous orders for caustic soda for export have gone unfilled. In some instances production of chemicals is retarded by scarcity of raw materials. This is particularly noted in the case of lead pigments where a reduction in second-quarter production has been enforced because of a smaller allotment of the metal to corroders.

Looking to the future, it was estimated some months ago that the process industries had new construction plans which would call for an expenditure of $800,000,000. More recent developments connected with scarcity of building materials and non-residential constructions imposed by CPA have made uncertain the time when much of this expansion can get under way. However, a schedule for enlarged capacities for plastics calls for a gradnated scale of new completions which by the middle of 1947 will add 300,000,000 lb. to current capacities. The rubber industry which had its largest peacetime output in 1940 expects that its 1946 output will come close to 90 percent in value above that of 1940.

With some of the large consumers of rosin raising their estimates of requirements, the question of supplies has been under examination. Originally it had been expected that new production of wood rosin would get into operation early this year with further additions to follow. Delays in such plans and the statistical position of the market bring fears that a shortage may develop in the fall months. The industry has advocated larger export quotas for rosin but present studies are concerned with a reduction in export quotas in order to conserve stocks for the domestic trade.





FOR WORKABLE SHEET MATERIALS ...SEE REVERE

THESE pictures show plant equipment in special shapes and large sizes, fabricated of Revere sheet copper and sheet Herculoy by the Camden Copper Works, Camden, N. J. They illustrate the amazing versatility of these metals, which skilled coppersmiths the country over fabricate into practically any desired shapes from the flat.

Easy workability of course means faster and more accurate fabrication of apparatus for your plant. It may also mean lower prices from the fabricator, or lower labor costs in your own plant if you make your own equipment. Whether the final form be simple or complicated, the workability of copper and its alloys is a tremendous advantage.

More than this, copper's high heat conductivity may speed up processing, and cut fuel expense.

Copper resists attack by many substances, and thus has a long, sometimes endless life. Often copper pipes and vessels are replaced only because of a change in the plant; then the metal has a high reclaim value.

The Revere Technical Advisory Service will gladly cooperate with you in working out applications of copper, whether plate, sheet, strip or roll, or in other mill forms such as pipe and tube, rod and bar, and extruded shapes. Write Revere or see your Revere Distributor.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.

Sales Offices in principal cities, distributors everywhere

Listen to Exploring the Unknown *on the Mutual Network every Sunday Evening, 9 to 9:30 p.m., EST.*

United States Production of Certain Chemicals

January 1946 and January 1945

Chemical and Basis	Units	January 1946	January 1945
Ammonia, synthetic anhydrous[1]	Tons	41,217	40,863
Ammonia nitrate (100% NH_4NO_3)	Tons	37,695	.....
Calcium carbide (commercial)	Tons	45,192	61,759
Calcium phosphate:			
Monobasic (100% $CaH_4(PO_4)_2$)	M lb.	5,569	4,716
Dibasic (100% $CaHPO_4$)	M lb.	7,750	3,519
Carbon dioxide:			
Liquid and gas	M lb.	17,630	16,442
Solid (dry ice)	M lb.	38,358	41,274
Chlorine	Tons	89,637	103,953
Chrome green (C.P.)	M lb.	1,748	646
Chrome yellow and orange (C.P.)	M lb.	4,617	3,356
Copper acetoarsenite (paris green)	M lb.	.....	625
Hydrochloric acid (100% HCl)	Tons	26,799	35,155
Hydrofluoric acid	M lb.	2,204	.....
Hydrogen	M cu. ft.	1,405,000	2,071,000
Lead arsenate (acid and basic)	M lb.	6,229	8,593
Molybdate chrome orange (C.P.)	M lb.	464	137
Nitric acid (100% HNO_3)	Tons	34,769	40,876
Oxygen	M cu. ft	721,506	1,393,942
Phosphoric acid (50% H_3PO_4)	Tons	68,534	51,264
Soda ash (commercial sodium carbonate):			
Ammonia soda process (98–100% Na_2CO_3)			
Total wet and dry[2]	Tons	387,012	365,718
Finished light[3]	Tons	196,492	185,516
Finished dense	Tons	132,339	124,948
Natural[4]	Tons	17,645	14,468
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	15,132	12,614
Sodium bichromate and chromate	Tons	7,735	6,582
Sodium hydroxide (100% NaOH):[5]			
Electrolytic process:			
Liquid	Tons	85,846	97,740
Solid	Tons	17,757	19,461
Lime soda process:			
Liquid	Tons	68,427	63,369
Solid	Tons	21,618	19,860
Sodium phosphate:			
Monobasic (100% NaH_2PO_4)	Tons	1,244	1,101
Dibasic (100% Na_2HPO_4)	Tons	5,727	4,090
Tribasic (100% Na_3PO_4)	Tons	9,216	6,875
Meta (100% $NaPO_3$)	Tons	2,272	1,934
Tetra (100% $Na_4P_2O_7$)	Tons	4,343	2,861
Sodium silicate (anhydrous)	Tons	34,524	38,397
Sodium sulphate:			
Anhydrous (refined) (100% Na_2SO_4)	Tons	7,864	5,258
Glauber's salt and crude salt cake	Tons	53,575	64,336
Sulphuric acid (100% H_2SO_4):[7]			
Chamber process	Tons	238,209	295,940
Net, contact process[6]	Tons	432,680	477,800
Zinc yellow (zinc chromate) (C.P.)	Tons	.....	1,429

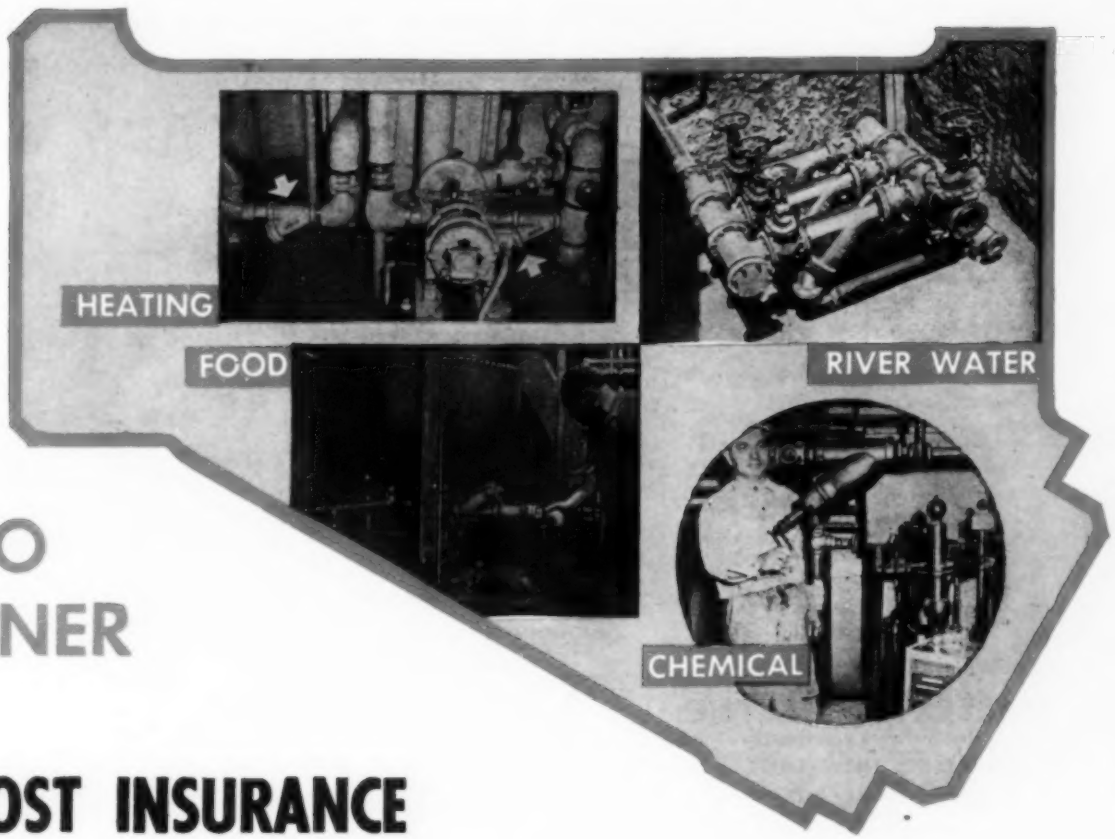
Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Includes oleum grades. Excludes spent acid. [7] Data for sulphuric acid manufactured as a byproduct of smelting operations are no longer included. This production by eight plants accounted for approximately four percent of the 1945 total production.

United States Production of Certain Synthetic Organic Chemicals

December 1945, December 1944 and Annual Totals for 1945 and 1944

Chemical	December 1945	December 1944	Total, Twelve Months 1945	Total, Twelve Months 1944
Acetanilid, technical and U.S.P.	.....	.....	6,951,294	4,610,813
Acetic acid:				
Synthetic[1]	22,476,478	24,701,553	281,024,370	231,953,917
Recovered	63,616,951			
Natural[2, 3]	1,845,913	3,239,071	31,945,[illegible]	40,489,764
Acetic anhydride[3]	44,294,[illegible]	43,870,666	526,255,258	493,654,125
Acetone	25,5[illegible]	.....	.....	.....
Aniline	2,9[illegible]	.....	.....	.....

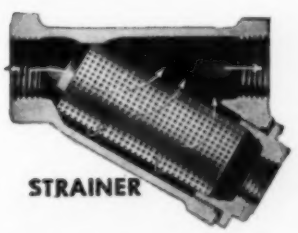
(Continued on page 324)



THE SARCO STRAINER

LOW COST INSURANCE

Sarco Strainers are effective and inexpensive insurance against costly shut-downs and heavy repair bills caused by dirt or scale in pipe lines. Keep a supply on hand and slip them in whenever changes are made. The cost is negligible.



STRAINER

FOR FOOD, CHEMICALS AND OIL

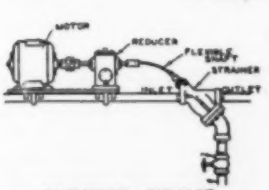
Sarco strainers are used to strain such products as syrup, varnish, orange juice, fuel and lubricating oils in the process of manufacture. Chemical and steel industries using large quantities of river water employ strainers on pipe lines up to 8 inches.

SCRAPER STRAINER

The SARCO SCRAPER STRAINER (Patented)

A helical, knife-like scraper rotated by hand or by motor is fitted snugly inside the screen wall, for conditions requiring continuous removal of solids without interruption of service.

Standard Sarco strainers are made in four types, ¼" to 8" for pressures up to 900 pounds. Scraper strainers ¾" to 8" and 200 pounds. Ask for Bulletin No. 1200.



MOTOR DRIVE

114

FOUR STARS ON OUR E PENNANT TESTIFY TO SARCO PERFORMANCE IN THE WAR EFFORT

SARCO SAVES STEAM

Represented in Principal Cities

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U. S. Production of Synthetic Organic Chemicals (Cont. from p. 322)

Chemical	December 1945	December 1944	Total, Twelve Months 1945	Total, Twelve Months 1944
Acetylsalicylic acid	910,287	845,689	10,860,346	9,256,636
Barbituric acid derivatives:[3]				
5-Ethyl-5-phenylbarbituric acid and salts (Phenobarbital)	15,863	13,776	276,763	234,074
Benzene:				
Motor grade:				
Tar distillers[4]	487,426	.....	.....	.....
Coke-oven operators[5]	4,812,492	.....	.....	.....
All other grades:				
Tar distillers[4]	1,314,228	.....	.....	.....
Coke-oven operators[5]	8,780,556	.....	.....	.....
Butyl alcohol, primary, normal	10,013,322	.....	.....	.....
Carbon bisulphide	26,620,669	.....	.....	.....
Carbon tetrachloride	13,080,177	.....	.....	.....
Chlorobenzene, mono	19,094,194	.....	.....	.....
Creosote oil:				
Tar distillers	9,694,584	10,813,362	127,277,483	121,149,971
Coke-oven operators	2,364,237	3,420,784	35,459,883	41,425,558
Cresols:[7]				
Meta-para	544,319	735,683	7,833,171	7,072,828
Ortho-meta-para	.....	654,067	9,708,599	9,910,680
Cresylic acid, refined[7]	2,108,164	3,076,886	29,224,088	40,725,366
Dibutyl phthalate	1,180,722	.....	.....	.....
Dichlorodiphenyltrichloroethane (DDT)	3,183,288	.....	.....	.....
Ethyl acetate (85%)	7,109,575	9,851,538	103,654,106	108,181,447
Ethyl ether, technical and U.S.P.	3,020,034	6,873,034	75,580,610	69,756,963
Formaldehyde (37% by weight)	29,252,064	.....	.....	.....
Methanol:				
Natural[9]	1,568,355	1,792,800	18,665,040	22,267,904
Synthetic	45,304,861	38,850,640	491,463,922	473,299,200
Naphthalene:				
Tar distillers (less than 79° C.)[4]	14,893,551	18,005,189	205,922,508	203,085,250
Tar distillers (79° C and over)[4]	7,015,898	6,216,754	77,227,365	82,138,629
Coke-oven operators (less than 79° C.)[5]	7,036,372	8,032,656	87,539,004	102,638,980
Penicillin[8]	841,129	.....	.....	.....
Phenol (synthetic and natural)[7]	14,738,105	.....	.....	.....
Phthalic anhydride	8,555,102	10,778,529	123,311,944	124,063,494
Styrene (government owned plants only)	24,412,751	.....	.....	.....
Sulfa drugs[8]	455,770	359,925	5,735,990	4,455,193
Toluene:				
Coke-oven operators[5]	1,668,847	.....	.....	.....
All other[5, 10]	919,051	.....	.....	.....

All data in pounds except benzene (gal.), creosote oil (gal.), toluene (gal.), and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1] Excludes the statistics on recovered acid. [2] Acid produced by direct process from wood and from calcium acetate. [3] All acetic anhydride including that from acetic acid by vapor-phase process. [4] Product of distillers who use purchased coal tar only. [5] Statistics are given in terms of bulk medicinals only. [6] Statistics collected by Bureau of Mines. [7] Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8] Reported to U. S. Bureau of the Census. [9] Reported in gal. by Bureau of the Census but converted to lb. for comparison with the production of synthetic methanol. [10] Includes toluene produced from petroleum by any process.

PUT THEM WITHIN *Easy reach...*

You can't wait to "write for samples" when you have an experiment under way. So send for samples of Alorco Aluminas now, to have ready on the shelf. We'll gladly send a pound or a hundred pounds; yes, a ton, if the job's real "hot".

Alorco Aluminas are being employed in the preparation of catalysts, as carriers and auxiliary catalysts, and used by the petroleum, rubber, and other chemical industries. They're serving to dry air, gases, and many organic liquids in processes where DRYness is all-important. Chemical companies use various Alorco Aluminas as the base material from which to make many products.

Name the Alorco products you'd like to have on the shelf, and we'll send you those samples. Call the nearby Alcoa office, or write ALUMINUM ORE COMPANY, 1910 Gulf Building, Pittsburgh 19, Pennsylvania.

ALUMINUM ORE COMPANY

Aluminas and Fluorides

ALORCO

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

CHEM. & MET.

Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	**109.13**
Last month	109.13
April, 1945	108.93
April, 1944	109.55

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to April 11.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.06 –
Acid, acetic, 28% bbl., 100 lb	3.38 – $3.63
Boric, bbl., ton	109.00 – 113.00
Citric, kegs, lb	.20 – .23
Formic, cbys., lb	.10½ – .11
Hydrofluoric, 30%, drums, lb	.08 – .085
Lactic, 44% tech., light, bbl., lb	.073 – .075
Muriatic, 18°, tanks, 100 lb	1.05 –
Nitric, 36°, carboys, lb	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½ – .12½
Phosphoric tech., tanks, lb	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb	.62 – .65
Alcohol, amyl	–
From pentane, tanks, lb	.13½ –
Alcohol, butyl, tanks, lb	.10½ – .20
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal	.542 –
Alum, ammonia, lump, lb	.04½ –
Aluminum sulphate, com. bags 100 lb	1.15 – 1.49
Ammonia, anhydrous, cyl., lb	.14½ –
tanks, ton	59.00 – 69.00
Ammonium carbonate, powd., casks, lb	.09½ – .10
Sulphate, wks, ton	28.20 –
Amyl acetate, tech. from pentane, tanks, lb	1.45 –
Aqua ammonia, 26°, drums, lb	.02½ – .03
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb	.09½ – .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran, bags, 100 lb	45.00 –
Calcium acetate, bags, 100 lb	3.00 –
Arsenate, dr., lb	.07½ – .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride, drums, gal	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb.	1.75 – 2.00
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb	.19½ – .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.50 – .52
Diethylene glycol, dr., lb	.14½ – .15½
Epsom salt, dom., tech., bbl., 100 lb.	1.80 – 2.00
Ethyl acetate, tanks, lb	.107
Formaldehyde, 40%, tanks, lb. wks.	.032
Furfural, tanks, lb	.09½ –
Glaubers salt, bags, 100 lb	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18½ – .19
Lead:	
White, basic carbonate, dry, casks, lb	.08½ –
Red, dry, sck., lb	.09½ –
Lead acetate, white crys., bbl., lb	.12½ – .13
Arsenate, powd., bag, lb	.11½ – .12
Lithopone, bags, lb	.04½ – .04½
Magnesium carb., tech., bags, lb	.07½ – .08
Methanol, 95%, tanks, gal	.60 –
Synthetic, tanks, gal	.24 –
Phosphorus, yellow, cases, lb	.23 – .25
Potassium bichromate, casks, lb	.10½ – .10½
Chlorate, pwd., lb	.09½ – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07½
Muriate, 60%, bags, unit	.53½ –
Nitrate, ref., bbl., lb	.08 – .09
Permanganate, drums, lb	.19½ – .20
Prussiate, yellow, casks, lb	.16 – .17
Sal ammoniac, white, casks, lb	.0515 – .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb	1.05 –
Dense, bags, 100 lb	1.15 –
Soda, caustic, 76% solid, drums, 100 lb	2.30 – 3.00
Acetate, del., bbl., lb	.05½ – .06
Bicarbonate, bbl., 100 lb	1.70 – 2.00
Bichromate, bags, lb	.07½ – .08
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb	.03 – .04

CHEM. & MET.

Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.80
Last month	145.80
April, 1945	145.85
April, 1944	145.24

Chlorate, kegs, lb	$0.06½ –	$0.06½
Cyanide, cases, dom., lb	.14½ –	.15
Fluoride, bbl., lb	.07 –	.08
Hyposulphite, bags, 100 lb	2.25 –	2.50
Metasilicate, bbl., 100 lb	2.50 –	2.65
Nitrate, bulk, ton	27.00 –	
Nitrite, casks, lb	.06½ –	.07
Phosphate, tribasic, bags, 100 lb.	2.70 –	
Prussiate, yel., bags, lb	.10½ –	.11
Silicate, 40°, dr., wks., 100 lb	.80 –	.85
Sulphite, crys., bbl., lb	.02½ –	.02½
Sulphur, crude at mine, long ton	16.00 –	
Dioxide, cyl., lb	.07 –	.08
Dioxide, tanks, lb	.04 –	
Tin crystals, bbl., lb	.39½ –	
Zinc chloride, grain, bbl., lb	.05½ –	.06
Oxide, lead free, bags, lb	.07½ –	
Oxide, 5% leaded, bags, lb	.07½ –	
Sulphate, bbl., cwt	3.85 –	4.00
OILS AND FATS		
Castor oil, No. 3 bbl., lb	$0.14½ –	$0.15½
Chinawood oil, tanks, lb	.38 –	
Coconut oil, Ceylon, N. Y., lb	.0885–	
Corn oil crude, tanks (f.o.b. mill), lb.	.12½ –	
Cottonseed oil crude (f.o.b. mill), tanks, lb	.12½ –	.12½
Linseed oil raw, car lots, bbl., lb	.155–	
Palm, casks, lb	.0865–	
Peanut oil, crude, tanks (mill), lb	.12½ –	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.11½ –	
Menhaden, light, pressed, dr., lb	.13 –	
Crude, tanks (f.o.b. factory) lb	.089–	
Grease, yellow, loose, lb	.08½ –	
Oleo stearine, lb	.09½ –	
Oleo oil, No. 1, lb	.11½ –	
Red oil, distilled, bbl., lb	.13 –	
Tallow extra, loose, lb	.08½ –	
COAL-TAR PRODUCTS		
Alpha-naphthol, crude, bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.11½ –	.12½
Aniline salts, bbl., lb	.22 –	.24
Benzaldehyde, tech., dr., lb	.45 –	.50
Benzidine base, bbl., lb	.70 –	.75
Benzoic acid, USP, kegs, lb	.54 –	.56
Benzol, 90%, tanks, works, gal	.15 –	
Benzyl chloride, tech., dr., lb	.22 –	.24
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, USP, dr., lb	.10½ –	
Cresylic acid, dr., wks., gal	.81 –	.83
Diphenyl, bbl., lb	.15 –	
Diethylaniline, dr., lb	.40 –	.45
Dinitrotoluol, bbl., lb	.18 –	.19
Dinitrophenyl, bbl., lb	.22 –	.23
Dip oil, 15%, dr., gal	.23 –	.25
Diphenylamine, dr., f.o.b. wks., lb	.25 –	
H acid, bbl., lb	.45 –	.50
Hydroquinone, bbl., lb	.90 –	
Naphthalene, flake, bbl., lb	.07 –	.07½
Nitrobenzene, dr., lb	.08 –	.09
Para-cresol, bbl., lb	.41 –	
Para-nitroaniline, bbl., lb	.42 –	.43
Phenol, USP, drums, lb	.10 –	.11
Picric acid, bbl., lb	.35 –	.40
Pyridine, dr., gal	1.55 –	1.60
Resorcinol, tech., kegs, lb	.65 –	.70
Salicylic acid, tech., bbl., lb	.26 –	.33
Solvent naphtha, w.w., tanks, gal	.26 –	
Toluidin, bbl., lb	.96 –	
Toluol, drums, works, gal	.32 –	
Xylol, com., tanks, gal	.25 –	
MISCELLANEOUS		
Casein, tech., bbl., lb	$0.24 –	$0.28
Dry colors:		
Carbon gas, black (wks.), lb	.0365–	.097
Prussian blue, bbl., lb	.36 –	.37
Ultramarine blue, bbl., lb	.11 –	.26
Chrome green, bbl., lb	.23 –	.33
Carmine, red, tins, lb	4.60 –	4.75
Para toner, lb	.75 –	.80
Vermilion, English, bbl., lb	2.50 –	2.60
Chrome, yellow, C.P., bbl., lb	.16 –	.17
Gum copal, Congo, bags, lb	.09 –	.55
Manila, bags, lb	.09 –	.15
Damar, Batavia, cases, lb	.10 –	.22
Kauri, cases, lb	.18 –	.60
Magnesite, calc., ton	64.00 –	
Pumice stone, lump, bbl., lb	.05 –	.07
Rosin, H., 100 lb	7.43 –	
Shellac, orange, fine, bags, lb	.46 –	
Bleached, bonedry, bags, lb	.42½ –	
T. N., bags, lb	.35½ –	
Turpentine, gal	.93½ –	.94½

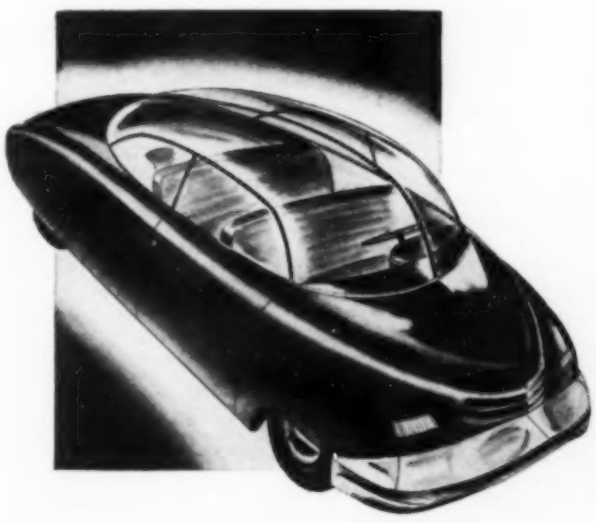
Shell Chemical Corporation is pledged to progress . . . to continually seek new and better ways for petroleum derivatives to serve industry.

To this end, present products are constantly being improved and directed toward new uses . . . other products are being formulated to fulfill new requirements. In many cases it is necessary to design and build new equipment to do a research job that has never been done before.

The lathe for working glass pictured here aids in the creation of specialized equipment needed in evaluating new chemical products formulated for industrial applications

ISOPROPYL ALCOHOL

low-boiling latent solvent



Durable high gloss nitrocellulose lacquers are more economically formulated with Isopropyl Alcohol. The secret lies in Isopropyl's evaporation rate . . . which allows the use of less high boiling alcohol to produce satisfactory blush resistance and flow-out.

For the same reason Isopropyl aids in the production of rapid-drying high solids lacquers.

Recently improved processing resulting in a higher standard of purity, increases the value of Isopropyl Alcohol for pharmaceutical, germicidal and cosmetic use.

Vitamin and food processors are finding Isopropyl Alcohol valuable as an extractant.

ISOPROPYL ALCOHOL IS AVAILABLE IN DRUM, COMPARTMENT OR STRAIGHT TANK CAR QUANTITIES

SHELL CHEMICAL CORPORATION

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Los Angeles • Houston • St. Louis • Chicago • Cleveland

NEW CONSTRUCTION

	Current Projects		Cumulative 1946	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	$540,000	$1,683,000
Middle Atlantic	$300,000	$300,000	996,000	2,131,000
South	80,000	430,000	9,870,000	19,198,000
Middle West	2,488,000	900,000	9,128,000	32,724,000
West of Mississippi	18,790,000	5,940,000	45,840,000	19,819,000
Far West	190,000	65,000	1,315,000	6,409,000
Canada	405,000	6,230,000	405,000	14,863,000
Total	$22,253,000	$13,865,000	$68,094,000	$96,827,000

PROPOSED WORK

Ark., Benton—Owosso Manufacturing Co., Benton, plans to rebuild its veneer plant recently destroyed by fire. Estimated cost $40,000.

Ark., El Dorado—Lion Oil Co. plans to construct a catalytic cracking unit here to produce hi-octane gasoline, furnace oil, etc. Estimated cost will exceed $750,000.

Calif., Oakland—Walter N. Boysen Co., 42nd and Linden Sts., plans to construct an addition to its paint and varnish factory. Reynolds & Chamberlain, 3833 Piedmont Ave., Archts. Estimated cost $150,000.

Calif., Martinez—Shell Oil Co., 100 Bush St., San Francisco, plans to construct a 2 story laboratory building with provision for a third floor. Estimated cost will exceed $40,000.

Ill., Carbondale—Koppers Co., Inc., Wood Preserving Div., Broad St. Sta. Bldg., Philadelphia, Pa., plans to rebuild three buildings recently destroyed by fire. Estimated cost $500,000.

Ill., Springfield—Springfield Paint Manufacturing Corp., 14th and Ridgley Sts., plans to construct a 1 story factory building within the next year to cost $25,000 and a 2 story building within two years to cost $53,000.

Ind., Hartford City—Fulton Glass Co., East Washington St., Muncie, Ind., plans to rebuild its plant recently destroyed by fire. Estimated cost $60,000.

Ind., Muncie—Owens-Illinois Glass Co., Muncie, plans to improve and construct additions to its plant. Estimated cost $100,000.

La., New Orleans—Flintkote Co., 4500 North Galveston St., plans to construct a 2 and 3 story industrial building. Billingsley Engineering Co., Interstate Bldg., Eng.

N. J., Carney's Point—E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del., plans to construct a new plant here. Estimated cost $100,000.

N. J., Deepwater—E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del., plans to repair fire and explosion damage to processing plant at Chambers Works. Estimated cost $60,000.

N. C., Burlington—Celanese Corp. of America, 180 Madison Ave., New York, N. Y., plans to construct an addition to its plant and install elevator.

O., Brecksville—B. F. Goodrich Co., Akron, O., plans to construct a group of laboratory buildings on Cleveland-Akron Hy., here. Estimated cost $1,750,000.

Pa., Erie—Hammermill Paper Co., Erie, plans to construct a 2 story addition to its plant. Estimated cost $100,000.

Pa., Philadelphia—Quaker City Japanning & Enameling Co., 916 Cherry St., plans to rebuild its plant recently damaged by fire. Estimated cost $40,000.

Tex., Brownsville—Hydrocarbon Research, Inc., 115 Broadway, New York, N. Y., plans to construct a synthetic gasoline plant to produce gasoline from natural gas and other products. Estimated cost $14,000,000.

Tex., Houston—Stanolind Oil & Gas Co., Gulf Bldg., plans to construct a plant here to conserve and utilize wasted flare gas. Estimated cost $4,000,000.

Ont., Belleville—Geen Drugs Ltd., Belleville, plans to construct a chemical manufacturing plant. Estimated cost $50,000.

Ont., Toronto—Atlas Chemical Co., 127 Roslin St., plans to construct a chemical manufacturing plant. Estimated cost $40,000.

Ont., Toronto—C. G. Beveridge & Co., Ltd., 10 East Adelaide St., plans to construct a plant for the manufacture of disinfectants, deodorizes, etc. Estimated cost $40,000.

Ont., Toronto—British Drug Houses of Canada, Ltd., Terminal Warehouse Bldg., plans to construct a factory on Queen Elizabeth Hy. Estimated cost $200,000.

Ont., Toronto—Seelite Plastic Enterprises, Ltd., 293 Bay St., plans to construct a new plant on Villier St. Estimated cost $75,000.

CONTRACTS AWARDED

Ark., Little Rock—Acme Brick Co., 208 Louisiana St., will remodel its plant and install new machinery. Work will be done by owner. Estimated cost $150,000.

Ill., Chicago—Enterprise Paint Manufacturing Co., 337 South Peoria St., has awarded the contract for remodeling its factory and office building to E. H. Marhoefer, Jr., 222 North Bank Dr., at $140,000.

Ill., North Chicago—Atlas Powder Co., Zapon Div., Marquette St., has awarded the contract for a 5 story factory to Campbell-Lowrie-Lautermilch Co., 400 West Madison St. Estimated cost $300,000.

Md., Relay—Jos. E. Seagram Sons, Louisville, Ky., has awarded the contract for 6 story distillation plant to Consolidated Engineering Co., 20 East Franklin St., Baltimore, Md. Estimated cost $300,000.

Mich., Detroit—Michigan Chrome & Chemical Co., 6340 East Jefferson Ave., has awarded the contract for a plant addition to Cunningham-Rudy Co., 3087 West Grand Blvd. Estimated cost $60,000.

O., Findlay—Ohio Oil Co., has awarded the contract for a factory and office building to Sam W. Emerson Co., 1836 Euclid Ave., Cleveland. Estimated cost $400,000.

Ore., Wilbridge—California Asphalt Corp., 225 Bush St., San Francisco, has awarded the contract for a tool room and office building at its refinery to W. C. Smith, Inc., Board of Trade Bldg., Portland, Ore. Estimated cost $65,000.

Tex., Freeport—Dow Chemical Co., Freeport, has awarded the contract for an addition to glycol plant and a hydro-carbon or methyl chloride plant to Tellepsen Construction Co., 3900 Clay St., Houston. Estimated cost $150,000.

Tex., Houston—International Rubber & Plastic Co., L. E. Scherck, Pres., has awarded the contract for a 1 story, 150x150 ft. plant building to Marxen & Son, 1921 Westheimer Rd., Houston. Estimated cost $100,000.

Tex., LaPorte—E. I. du Pont de Nemours & Co., LaPorte, and Du Pont Bldge, Wilmington, Del., will construct a chemical manufacturing plant. Work will be done by owners. Estimated cost $2,500,000.

Tex., Lufkin—Southland Paper Mills, Inc., c/o E. Kurth, has awarded the contract for doubling the capacity of its paper mill to Brown & Root, Inc., P. O. Box 3, Houston. Estimated cost $2,000,000.

Tex., San Marcos—Texas Ceramics Products Corp., c/o A. K. Moulton, will construct a ceramics manufacturing plant. Work will be done by owner. Estimated cost $40,000.

Tex., Wink—C. V. Lyman, Midland, will construct a natural gasoline plant, also repressuring unit adjacent to plant. Work will be done by force account. Estimated cast $750,000 and $250,000 respectively.

W. Va., Grafton—Hazel Atlas Glass Co., 15th and Jacob Sts., Wheeling, has awarded the contract for two additions to its factory to Washington Engineering & Construction Co., Oakland and Pennsylvania Aves., Washington, Pa. Estimated cost $230,000.

W. Va., Newell—New Castle Refractories Co., New Castle, Pa., has awarded the contract for the construction of a manufacturing plant and tunnel kilns to Nellis Construction Co., East Liverpool, O. Estimated cost $200,000.

B. C., Vancouver—St. Regis Paper Co., 146 West Second Ave., has awarded the contract for a plant to Dominion Construction Co., Ltd., 150 West Second Ave. Estimated cost $160,000.

Ont., Hamilton—Steel Co. of Canada, Ltd., Hamilton, has awarded the contract for a coke plant to Wilputte Construction Co., Inc., 40 Rector St., New York, N. Y. Estimated cost $6,000,000.

Ont., Toronto—Film Laboratories of Canada, Ltd., 358 Adelaide St., W., has awarded the contract for a plant on Jennings Ave., to Milne & Nicholls, Ltd., 57 Bloor St., W. Estimated cost $70,000.